ASSESSMENT OF LEARNING TOOLS IN THE CONTEXT OF DIFFERENT LEARNING APPROACHES: THE CASE OF STRIGA BIOLOGY AND MANAGEMENT IN DODOMA

BY

EMMANUEL NYANKWELI

A DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF ARTS IN RURAL DEVELOPMENT OF SOKOINE UNIVERSITY OF AGRICULTURE.

MOROGORO, TANZANIA.

2003

ABSTRACT

A study to assess learning tools and approaches for improving farmers' and other stakeholders' knowledge as well as understanding of *Striga* biology was carried out in Dodoma rural, at Chipanga 'A' and Mvumi Makulu villages. *Striga* is a nuisance weed in cereal production and farmers understand it as a primary yield reducer. Despite this fact, there is a general lack of awareness of the problem, especially concerning the biological aspects of *Striga*. Previous research findings reveal that farmers have little understanding of *Striga* biology. A multi-phase data collection method was employed whereby 133 respondents were consulted in a series of focus group discussions, in-depth and key informant interviews. The cut and sort analysis of information transcripts was performed. Also SPSS was employed on the evaluation of radio as a learning tool. Training needs for farmers and other stakeholders were assessed and various factors influencing the use of knowledge were explored. The results revealed that farmers and other stakeholders in Tanzania had known *Striga* before independence. Farmers were noted assigning different names to *Striga*, which reflects the nature of the weed and its effect on crops. They were able to describe the types of soils where *Striga* is prevalent as well as some control measures. However most of the farmers control *Striga* by hand hoe weeding and uprooting since their social economic conditions do not fit the new methods. Moreover farmers and other stakeholders have indicated that *Striga* does not only attack the fields of economically poor farmers, but rather cuts across all groups regardless of their economical status and the weed has potential to increase and spread to

other uninfected areas. Farmers identified several sources of agricultural information, which are researchers, extension staff, family members (parent and relatives), neighbouring farmers, distant farmers as well as non-governmental organisations. No learning tool was taken as superior to others in conveying knowledge to farmers, rather the suggestion is to use a combination of learning tools and approaches to meet this crucial goal. Nevertheless, most (about 60 percent) farmers in Dodoma rural do not have radios and a similar proportion farmers confessed that they never heard of any agricultural programme through the radio. About ninety per cent of the farmers had never heard about *Striga* through the radio. The study recommends the use community theatres and competent resource farmers to send across messages concerning *Striga*. It also recommends initiating radio farm forums in future as this approach has potential to reach many farmers in the rural population.

DECLARATION

I, EMMANUEL NYANKWELI, do hereby declare to the Senate of Sokoine University of Agriculture that this dissertation is my own original, and has not been submitted for a higher degree in any other University.

Signature.....

Date.....30/01/03

COPYRIGHT

ACKNOWLEDGEMENT

Many people have contributed much to the success of this study, so much so that it would be impossible to mention them all. I am grateful to my family who financed my studies at Sokoine University of Agriculture (SUA) and the Department For International Development (DFID) Crop Protection Program (CPP) *Striga* project for funding my research.

I am highly indebted to my supervisors at SUA, Dr. E.A. Mwageni, and Prof. A.Z. Mattee, for their invaluable comments, guidance, constructive challenges and close supervision, which made this work possible. My appreciation is also due to Dr. A.M. Mbwaga, Dr. C.R. Riches, and Mr. R.I. Lamboll, for their interest to see this work completed. I am also very grateful to Mr. J.P Hella, for linking me with the *Striga* project.

I am thankful to all staff and postgraduate students of Development Studies Institute (DSI) for their company and assistance throughout my study. I am indebted to Dr Mwachambi, the District Agricultural and Livestock Development Officer (DALDO) of Dodoma District and his staff for their eagerness to assist me during my study. Special thanks should go to Mrs Ulomi and Mr Kibaya, the village extension officers for Mvumi Makulu and Chipanga 'A' respectively, for enabling me to work smoothly in their villages. Last but not least, I am grateful to all people who contributed to the success of this work in one way or another. May God bless them all.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

LIST OF ABBREVIATIONS AND ACRONYMS

AIDS	-	Acquired Immuno Deficiency Syndrome
ARI	-	Agricultural Research Institute
ART	-	Action Research Training
BAFOD	-	Back-up to Farmer Organisational Dynamics
CAAs	-	Community Agricultural Advisors
CPP	-	Crop Protection Programme
DALDO		District Agricultural and Livestock Development Officer
DCT	-	Diocese of Central Tanganyika
DFE	-	Department of Farmers' Education
DFID	-	Department for International Development
DRD	-	Department of Research and Development
DSI		Development Studies Institute
ELA	-	Empathic Learning and Action
FAO	-	Food and Agricultural Organization
FARMESA		Farm-level Applied Research Methods For Eastern and Southern Africa
FEVs	-	Farmers Exchange Visits
FFS		Farmer Field School
FGDs	-	Focus Group Discussions
FRG	-	Farmer Researcher Groups

FYM	-	Farm Yard Manure
HADO		Hifadhi Ardhi Dodoma (Dodoma Land Conservation)
HIV	-	Human Immunodeficiency Virus
IFAD		International Fund for Agricultural Development
IFTz	-	Inades Formation Tanzania
INADES		Institut Africain pour le Développement Économique et Social (African Institute for Economic and Social Development)
IPM	-	Integrated Pest Management
ISFM	-	Integrated Soil Fertility Management
IWM	-	Integrated Weed Management
LUMP	-	Land Use Management Project
MAC	-	Ministry of Agriculture and Cooperatives
MAFS	-	Ministry of Agriculture and Food Security
NAEP II	-	National Agricultural Extension Project Phase II
NAIS	-	National Agricultural Information Services
NGOs	-	Non-governmental Organisations
NORAD	-	Norwegian Development Agency
NRI	-	Natural Resources Institute
OFR	-	On-farm Research
PARM	-	Participatory Action Research Methodology
PLAR	-	Participatory Learning and Action Research

PPIP	-	Plant Protection Improvement Programme
PTD	-	Participatory Technology Development
RFF	-	Radio Farm Forum
RTD		Radio Tanzania Dar es salaam
SMS	-	Subject Matter Specialist
SPSS		Statistical Package for Social Sciences
SRN		*Striga* Resistant Landrace
SUA	-	Sokoine University of Agriculture
T&V	-	Training and Visit
TARP-II	-	Tanzania Agricultural Research Project Phase II
TB	-	Tuberculosis
TOT	-	Transfer of Technology
UK	-	United Kingdom
UMADEP		Uluguru Mountains Agricultural Development Project
URT	-	United Republic of Tanzania
VEO	-	Village Extension Officer
WEO	-	Ward Executive Officer
WPs	-	Working Papers

CHAPTER ONE

INTRODUCTION

1.1 Background Information

Striga species in the family of *Scrophulariaceae*, commonly known as witchweed, is an intractable problem affecting cereal production in Africa. Heavy witch-weed infestation forces farmers to grow less of their staple requirements or worse, abandon their fields (Doggett, 1965; Kanampiu *et al.*, 1997; Mbwaga *et al.*, 2000; Kaswende *et al.*, 2000). Unlike other weeds, *Striga* is a parasitic weed with debilitating effects upon its hosts. It not only competes with crops for water, nutrients and light, but exerts a potent phytotoxic effect on its host which leads to stunted growth and hence reduced yields (Ramaiah *et al.*, 1983; Sauerborn, 1991).

Meir (1999), observed that very little information on farmers thinking and decision-making in pest/weed management is available. Often crop protection researchers have decided for pest/weed problems, and the huge variety of biophysical, climatic and economic factors, which affect pest/weed status. The control options are too complex for farmers to grasp in order to make effective decisions. Studies of human judgement and choices have shown that prescriptive models are unable to account for how people actually behave. Most people violate prescriptive principles because decision-making is behavioural in nature (Heong and Escalada, 1999).

Mumford and Norton (1984), noted that models of pest/weed management which assume that farmers merely wish to maximise profits and which base their judgement on economic thresholds have failed to provide a useful guide to actual farmer behaviour. This is attributed to the failure to account for the fact that pest/weed management decisions are subjective and depend very much on the individual farmer, his /her knowledge, views, goals, resources, risk averseness and values.

Striga research and control in Tanzania has a long history. It started in 1950-1957 in Lake Victoria Basin (Mbwaga *et al.*, 2000), and continued in 1988 to date (Kaswende *et al.*, 2000). The current effort on the development of integrated management of witchweed is concentrated in a project conducted Misungwi and Dodoma Districts. This project is funded by DFID-CPP and Government of Tanzania. Since then a lot of information related to *Striga* and its control has been collected but there is one step still needed, to influence the decisions of farmers on *Striga* control. That is, farmers lack knowledge of the biology of *Striga*, which is considered to be key in the control of the problem. The aim of this study is to identify existing learning approaches (methods and tools), which will aid in imparting knowledge of biological concepts to farmers and other stakeholders so that they can combat the witchweed and improve cereal productivity.

1.2 Problem Statement

Striga is a nuisance weed in cereal production and farmers understand it as a primary yield reducer (Ramaiah *et al.*, 1983). Despite this fact, there is a general lack of awareness of the problem, especially concerning the biological aspects of *Striga*. Previous research findings reveal that farmers have little understanding of *Striga* biology (Ramaiah *et al.*, 1983; Mbwaga *et al.*, 2000). They believe that *Striga* propagates in a manner similar to *Cynodon dactylon*, that is, by use of stolons (Mbwaga *et al.*, 2000). Therefore they leave the weeded *Striga* plants on the soil surface to dry within their fields (Mbwaga *et al.*, 2000; Kaswende *et al.*, 2000).

Empowering farmers with knowledge on the biology of *Striga* will be a great step towards the development of sustainable integrated *Striga* management. This is because massive damage of *Striga* to crops occurs underground before it emerges (Sauerborn, 1991). Many tools and approaches have been developed to meet this purpose. These tools and approaches include rhizotrons, pot experiments and printed materials (leaflets, posters, working papers and manuals). Others are radio programmes, community theatres (drama and songs) and *Striga* trials. This study examines these tools and approaches mainly because the Striga control project in Tanzania had used them previously.

1.3 Significance of the Study

Understanding basic biological mechanism of *Striga* is the key to empowering farmers and other stakeholders to adopt control methods, which are most appropriate for their socio-economic conditions (Esilaba et al., 1997). This will not only increase food production in *Striga* infected land, but will also bring back into cultivation lands, which were formerly forsaken because of *Striga* infestation (Ramaiah, 1983). Farmers' understanding of *Striga* biology will add more input to the research process and particularly put them in a better position to control *Striga* on their own fields.

1.4 Research Objectives

1.4.1 General objective

The main objective of the study is to assess learning tools and approaches which can be used for improving farmers' knowledge and understanding of *Striga* (witchweed), so as to facilitate decisions for intervention by farmers, extensionists and researchers, and therefore increase cereal productivity and ultimately improve the rural peoples' livelihoods.

1.4.2 Specific objectives

The study specifically intends to:

(i) Evaluate farmers' and other stakeholders' local knowledge and information in relation to *Striga* (witchweed) biology and management.

(ii) Assess the usefulness of knowledge and factors influencing the application of knowledge.

(iii) Identify farmers' training needs so as to improve their knowledge in the biology and management of *Striga*.

(iv) Identify and, to the extent possible, adapt learning tools for improving farmers' understanding of *Striga* biology.

(v) Evaluate the learning tools, which have been used in the *Striga* Control Project with respect to farmers' and other stakeholders' criteria.

This chapter has presented the background information on the knowledge of *Striga* and its control measures. It has highlighted the magnitude of the *Striga* problem and the general lack of awareness on this problem among different stakeholders. Finally the chapter presented the problem statement of the study, its justification and research objectives. In the next chapter a review of different learning approaches is made and learning tools to be evaluated for use in the *Striga* control project are identified.

CHAPTER TWO

LITERATURE REVIEW

2.0 Overview

This chapter discusses conceptual issues on learning approaches. Brief definitions and explanations of concepts of learning, learning approach, effective learning approach and how to measure effectiveness of learning approaches are provided in section one. Section two presents a comparative review of popular models of technology development. These are transfer of technology and participatory technology development, the section also describes local knowledge and its role in rural development. Section three has reviewed various extension and learning approaches while section four provides the status of *Striga* research in Tanzania. Section five provides a summary of this chapter.

2.1 Conceptual issues on Learning Approaches

2.1.1 Concept of learning

Wole (1995) defined learning as an enduring change in how we think, act and feel about things. The author revealed that in learning we get skills, facts and solve problems. Also we like or dislike others and further we learn how to learn. Learning is receiving and retaining knowledge (FAO, 1995). It is a process by which a person changes his/her behaviour through own efforts (Supe, 1997).

According to FAO (1995), learning is the result of an effort to know and understand the subject being studied. Further, learning consists of drawing close the reality, observing it, examining it and listening to trainers'/facilitators' instructions. Also it involves drawing certain conclusions, contrasting ones own conclusions with those of others and reading texts referring to the subject (FAO, 1995; Supe, 1997).

2.1.2 Learning approach

Learning approach refers to the style of receiving and retaining knowledge within the extension system (Axinn, 1988; Urio, 1996). The approach embodies the philosophy of the system and it is the essence of the system. It is like a doctrine for a system, which informs, stimulates and guides learning aspects of the system. The aspects of the system include structure, leadership program, method and techniques, resources as well as linkages with other organisations (Supe, 1997).

2.1.3 Effective learning approaches

Youndeowei and Kwarteng (1995) described effective learning and training approach as one which is authentic, appropriate (relevant), utilisable and that can facilitate adequate understanding of the intended information. Schwartz and Kampen (1992) referred to effectiveness in learning approaches as their ability to achieve goals (results).

Similar views were expressed by Kauzeni (1989), who argued that evaluation of learning approach effectiveness means measuring the enduring change on how farmers and other audiences think, act and feel about the intended intervention. Feuerstein (1986), NORAD (1997), Weihrich and Koontz (1993), defined the term effectiveness as a measure of the extent to which extension approaches are successful in enduring change on the audience (achieving the intended objectives).

2.1.4 Measuring effectiveness of learning approaches

Schuchardt and Cunningham (1987) argued that effectiveness is not easily measured and even less easily defined. This is attributed by the differences in perception of effectiveness of researchers and the circumstances in which effectiveness is determined. Moris (1991) found that a problem faced when analysing the effectiveness of extension approaches is the complex, organisational, social, cultural, economic and ecological setting that impinge on farmers, extensionists, researchers and NGOs.

Moris (1991) pointed out that no one profession or academic discipline encompasses all the major components. Those who see extension as technology transfer will focus on communicating information about new varieties and husbandry innovations to farmers, while those who deal with community problems will look at local leadership and how individual farmers participate in their communities. Those who analyse environmental trends will adopt geographical and zonal approaches.

According to Kauzeni (1989), effectiveness of extension approaches is gauged by achievement of existing activities in relation to assumed goals. Also effectiveness can be measured in terms of adoption of innovations, acquired knowledge of farming practices, improvement of yield, and sustenance of new innovations, time, cost and rate of disseminating information. MAC (1999), reported that analysis of the rate at which recommended improved agricultural technologies have been adopted by smallholder farmers provide a measure of the effectiveness of agricultural extension under NAEP II project.

2.2 Transfer of Technology versus Participatory Technology Development

2.2.1 Transfer of technology (TOT) approach

Rists (1993), documenting experiences from South America, viewed transfer of technology model to rural development as an approach whereby technology is derived/developed independently of the rural communities, for whom it was intended. For instance research is conducted at the research stations where scientists seek to improve various issues in agriculture such as soil fertility with new crop rotations, mixed cropping, organic fertilisers, biological control of plant diseases and so on. The packages or components of the technology are then tested on farmers' fields, where the basic unit of analysis is a single plot. Rists (1993), adds that the roles of the researchers and extension workers were defined as production of "new technology package" and

extending it to the farmers while the role of the community in rural settings is to receive new technology and use it.

Scoones and Thompson (1994) noted that the assumption behind TOT approach in agricultural transformation is a straightforward process, in which improvement is achievable through interventions and innovations of sensitive extension support agencies. The authors further noted that the technology is developed almost exclusively from the research findings of the research stations and transmitted to the farmer through hierarchical and technically oriented extension services. Farmers are considered as either "adopters" or "rejecters" of the technologies and not as originators of technical knowledge or improved practices. From his experience, Rists (1993), observed negligible interest of the farmers towards the new technology transferred to them and other institutions despite positive results of the TOT model to rural development.

2.2.2 Participatory technology development (PTD)

PTD is a holistic approach to technology development, which expands the unit of analysis from a single plot like TOT, to the whole complex of production system within its socio-economic and cultural context (Rists, 1993). The author described the roles of the researchers as overlapping with those of the extension workers while the latter is no longer the servant of the researcher.

Within the context of the PTD approach, it was no longer necessary to extend technological packages from research stations to the community since the technologies are derived and validated in the community itself with broader participation by the community members. Rists (1993), also observed that the relationship between the community and project transformed from the vertical one to a horizontal one, which is the basis for PTD approach This implies a permanent integration of the rural development professionals and the rural people.

2.2.3 Local knowledge and its role in rural development

Local knowledge is sometimes used synonymously with the term indigenous knowledge (Lazaro *et al.*, 2000). Warner (1991), defined local knowledge as the knowledge of the environment and procurement strategies based on intimate experience accumulated over many generations. Kajembe (1994), viewed it as the sum of experiences and knowledge of a given ethnic group that forms the basis for decision-making in the face of familiar problems. Further, it is the unique characteristic to a particular ethnic group (Warner, 1991; Kajembe, 1994).

Lugeye (1994), on the other hand, viewed local knowledge as the mixture of knowledge created endogenously within the society and that this knowledge is not static but continuously changing and has an inherent capacity for absorbing relevant new knowledge generated exogenously.

Rural communities have for decades developed and maintained knowledge and practices for management and conservation of natural resources, which they depend on for example water, soils and forests (Kamara, 1993). These knowledge and practices produced mutual understanding and identity among the members of the farming community where local technical knowledge, skills and capacity are inextricably linked to non technical ones like cultural, ecological and sociological factors (Moock and Rhoades, 1992).

It is argued convincingly (Moore, 1980; Basant, 1988) that the relevance and prospects of success of innovations brought in from outside will be enhanced if these are built upon local knowledge. Learning from farmers can be highly cost-effective, since such knowledge is not readily available to extensionists and researchers, and the techniques often relying on games and role playing have been devised to allow local knowledge to be elicited rapidly (Barker, 1980; Knight, 1980). The whole idea is to bridge the gap between development professionals (NGOs, researchers and extensionsts) and farmers as well as looking for new ways to understand local knowledge, strengthening of local capacities and meeting local needs (Scoones and Thompson, 1994).

2.3 Extension Approaches and Methods

Farmers, some extensionists and other stakeholders have very little understanding of *Striga* biology (Mbwaga, 1994). Current research findings for *Striga* research are based on a number of knowledge-based technologies. So far a wide range of approaches have been tried in different parts of the world, and it is widely recognised that "learning by doing" or "experiential learning" approaches are effective means of understanding relatively complex information and technologies.

It is considered important to undertake a thorough review of approaches together with an evaluation of learning tools, so that, this exercise will guide future research activities within the *Striga* project. It will also enable the project to choose within the range of approaches reviewed and operate efficiently in imparting the biological knowledge of *Striga* to farmers and other stakeholders. The approaches to be reviewed in this subsection are farmer field schools, participatory learning and action research, participatory action research methodology and empathic learning and action framework. Others include back up to farmer organisational dynamics, radio farm forum, community agricultural advisors, training and visit as well as community theatre.

2.3.1 Farmer field schools (FFS)

According to Braun *et al.* (2000), farmer field schools (FFS) are participatory platforms for improving decision-making capacity and stimulating local innovation for sustainable agriculture. They further described it as a community-based, non-formal education to groups of 20–25 farmers with discovery based learning which is related to agro-ecological principles in a participatory learning throughout a crop cycle. FFS focuses on identifying concrete solutions for local problems like occurrence of parasitic weeds such as *Striga hermonthica.* It increases the capacity of individual farmers and local groups for critical analysis and decision-making and it stimulates local innovation and emphasises on principles and processes rather than recipes of technology packages.

Braun *et al.* (2000), observed that FFS is a knowledge gap filling exercise that utilises holistic action research on agro-ecosystems and increases awareness and understanding of phenomena that are not obvious and easily observable. Further, FFS foundation is based on increasing farmers' skills as managers of the agro ecosystems. It aims at developing expertise in integrated weed management (IWM) and ending dependency on herbicides as the main or exclusive weed control measure.

Ooi (1996), and Braun *et al.* (2000), speculated that FFS offers an opportunity for learning by doing based on non-formal education principles. In the process, extension workers or trained farmers facilitate the learning process, encouraging farmers to

discover key agro-ecological concepts and to develop IPM skills through self-discovery activities practised in the field/farm.

For instance, in Indonesia the learning cycle in FFS for rice has weekly meetings throughout the crop cycle (three months). It usually begins with transplanting so that observations cover all critical phases of crop growth and improved decision making emerges from an iterative process of analysing a situation from multiple viewpoints, synthesising the analysis, making decisions accordingly, implementing the decisions, observing the outcome and then evaluating the overall impact. The new knowledge and insights at each stage require revision of earlier stages and modification of initial assumptions meaning FFS are flexible (Conway, 1987).

2.3.2 Participatory learning and action research (PLAR)

PLAR for Integrated Soil Fertility Management (ISFM) is a new approach to agricultural research and extension, which has been successfully introduced in western Kenya (Baltissen *et al.*, 2000). PLAR enables farmers to discover and experiment with soil fertility management practices on a step-by-step basis and promote joint learning between farmers.

The major objective is to encourage farmers to appropriate the PLAR process and facilitate demand-driven extension, which will eventually allow extension staff to shift

their attention to other extension units. Baltissen *et al.* (2000) pointed out that, PLAR starts with a community based assessment of current farming practices and sessions in which farmers draw up criteria to classify different farms in the village. Diagnosis of the situation at farm level is based on mapping resource flows between fields, livestock units, households and into and out of the farms, this then is followed by on farm experimentation as well as development of improved ISFM techniques and practices by farmers.

Baltissen *et al.* (2000), noted the initial PLAR implementation for ISFM in western Kenya has resulted in the formation of "satellite villages" in the seven pilot villages. These villages were then used as rural knowledge centres as they play a key role in scaling up PLAR work in the area, since the farmers from the villages can use their experience with PLAR to train and advice colleagues in neighbouring areas.

2.3.3 Participatory action research methodology (PARM)

PARM attempts to provide ways for those involved in complex situations (such as those whose land is infested with *Striga*) to begin finding answers for themselves (Engel, 1997). It does not give any answers directly but furnishes an approach to formation of a team and beginning to examine the social organisation of the system in the context of the problem to be tackled. Also it is meant for situations whereby working together can be expected to promote positive change and offers instruments for gathering, organising

and interpreting information in a participatory manner, that is, specialists working with farmers as co-researchers and facilitators.

Engel (1997), further argues that PARM can be used to focus on the present and potential social organisations of actors (groups and individuals) in a situation where innovation is desirable. The author argues further that PARM encourages the team to think about the system they are in, what they want from it, what it achieves and doesn't and what is needed for improvement. The interplay among actors with different world views, combined with various analytical perspectives stimulated by PARM, acts as a motor for the learning process as a team seeks an understanding of their problem, that is inclusive enough to deal adequately with its many facets.

Further, PARM promotes the development of a shared conceptual framework that can facilitate the flow or exchange of ideas, experiences and knowledge. Moreover PARM establishes a basis for implementation, because people work together in a process, hence tend to come up with a joint commitment to change, as they have identified their shared concerns and networks that are most relevant and can explore possible new alliances and begin to formulate action proposals that are realistic and implementable. PARM had been used in various agricultural and rural development projects in Colombia, Nigeria, Tanzania and in South America (Engel, 1997).

2.3.4 Empathic learning and action (ELA) framework

ELA framework is based on more than 20 years of experience in agricultural development in Ghana (Millar, 2001). It is explicit and addresses two different perceptions of reality, those of the rural people and the outsiders (researchers, extension workers, NGOs) who want to work with a rural community. In addressing these two perceptions, mutual-learning processes can be designed leading to important rural peoples' knowledge and more appropriate interventions by outsiders.

At first there is a need to enter the rural community with a cosmo vision perspective. Outsiders (NGOs, extension workers and researchers) for instance, are used to seek permission from the village head but Millar (1992) noted that sometime, they might need to seek permission from the ancestral God. According to Millar (2001), entering the community implies that permission from the ancestral spirits is sought and only by accepting and respecting these rules can a relationship of confidence be built with the community.

The author noted further that ELA framework had strengthened the farmers to experiment within their own farms. Also it motivated them to experiment within their own cultural context and has moved participation a step forward, making possible joint learning as well as experiential learning. For outsiders ELA built an institutional

capacity to go beyond conventional experimentation and had provided them with new ideas about the process of farmer experimentation.

2.3.5 Back-up to farmer organisational dynamics (BAFOD)

BAFOD is the approach used by INADES Formation–Tanzania (IFTz). It has been used in rural development activities in Mbeya, Morogoro, Njombe and Dodoma. It is an integrated approach that aims at stimulating and supporting a social change process owned, managed and controlled by farmers themselves. The approach is based on supporting of peasants' (rural peoples) initiatives to better organise and have a voice in society by contributing towards their capacity building (IFTz, 2000).

BAFOD foundation is in building the capacities of rural people through nurturing the dynamics which motivate them, hence, the name "Backup to farmers' organisational dynamics" which is implemented through action research training (ART) method. Experiences have shown that ART had widened the scope and vision of all actors that is rural people and trainers, further it is very effective in the promotion of farmer innovations (IFTz, 2000). ART is an evaluative, cyclic and iterative process whereby rural people (farmers) can slowly develop their thinking capacities and beliefs to become efficient as well as gradually being empowered. Further it is a process, which lead to social and political changes in rural areas.

2.3.6 Radio farm forums (RFFs)

The National Agricultural Information Services (NAIS) facilitated the formation of over 1000 farmer groups throughout Zambia (Kakunta, 2001). The objective of each group is to listen to radio programmes and use the information in their farming activities. The farmer groups are commonly known as Radio Farm Forums, and have a membership of 15–20 farmers living in a radius of five kilometres from the village where they meet. The motto for this approach is "listen, discuss and act", meaning that the groups listen to programmes, discuss contents and suggest techniques and solutions, then the group ideas and questions are forwarded to the producers of the programmes who feedback the expert advice on air or in writing and then farmers apply the lessons in the field.

According to NAIS the RFFs are participatory since farmers are formulating the messages (Kakunta, 2001). Each RFF elects its chairperson and secretary to take notes during the programme, then the members discuss the information and raise questions, which are recorded and sent to the producers, the answers are either communicated by writing or through the incoming radio programme. The producer regularly consults the experts and researchers for technical issues so that the feedback required is based on authentic and appropriate messages in order to earn trust for his/her listeners, the producer chooses topics of immediate benefit to the farmers.

2.3.7 Community agricultural advisors (CAAs)

Byaruhanga (2001) observed a need for more participatory strategies within extension systems. In his view, emphasis should be laid on strengthening of the capacities of local communities to take a lead in their own development. This motivated the training of the communities' own resource people, the community agricultural advisors.

According to Byaruhanga (2001), CAAs are cadres of trained members of the community selected from their farmers' groups, who work hand in hand with the extension staff to improve community livelihoods. The author noted that two volunteers are chosen from each 20 members on the criteria that they are willing to adopt and test a given technology or development activity; are respected, influential, credible and have a good relationship with the community. Further each volunteer should be ready to give his/her own time and has to be available; should also show interest and should have a volunteering spirit to take up the roles. The volunteer is supposed to be honest, humble and approachable, he/she should possess a sense of commitment, should not only think of his/her own welfare and should be capable and willing to train other farmers.

Byaruhanga (2001), further attributed the CAAs as trained to become model farmers in their communities where other farmers can easily come to learn; the training support focuses on enhancing the capacity of the CAAs to innovate, experiment and develop

their own farming systems in a sustainable way as well as increase their control over resources and decisions affecting their farms.

According to Byaruhanga (2001), the approach is cost-effective and sustainable since the CAAs live among the people and are a permanent source of knowledge and skills. Furthermore, CAAs can easily be reached by members of the community at any time. Their farms become classrooms where other farmers come to learn, and because CAAs are farmers who have tried out the agricultural technologies successfully, this makes it easy to convince other farmers that the technologies work. The CAAs are the authors of success and rightfully feel that the successes of technologies belong to the community.

2.3.8 Training and visit (T & V) extension

T & V was the main farmer training method for most public agricultural extension sevices in eastern and southern Africa. It was introduced in the 1980s, after achieving some success in India during the green revolution in 1970s (Kimakwa, 2001). Being prescriptive and rigid it has failed to value the social, cultural and economic factors in the rural development process.

T & V's foundation was built on bringing the so-called "better" technologies, which had worked on other countries, but without adapting them to local conditions. According to Kimakwa (2001), the information from experts or researchers is conveyed to Subject

Matter Specialists (SMSs) at monthly two-day meetings. The SMSs then pass the message to extension workers in fortnightly training sessions. Then the extension workers pass the message to the smallholder farmers over the next two weeks. One message may be repeated at a particular time of the year and sometimes for very many years regardless of whether it was/is still necessary or whether farmers had other priority needs or means to carry out the activity.

T & V system relied heavily on external resources, such that it became unsustainable and governments failed to maintain it after the donors' pullout. It was rigid and expensive, but even worse, it assumed farmers were empty bottles, that is, farmers did not know anything (Kimakwa, 2001). According to the author, T & V encouraged the belief that, "good" technology is introduced from elsewhere and further T & V capitalised on the number of sessions and number of trained farmers rather than the impact of the training on the farmers. This approach is therefore bureaucratic, top down and mechanistic.

2.3.9 Farmers exchange visits (FEVs)

FEVs are mechanisms, which allow farmers, researchers and extension workers to meet and share experiences (TARP II-SUA, 2001). The linkage among farmers, researchers and extension workers is an important means of facilitating and strengthening client-oriented and demand-driven research. In the process, researchers and extension workers

learn from farmers and farmers become an integral part of the research aimed at technology development (TARP II-SUA, 2001).

According to TARP II-SUA (2001), in FEVs, farmers from one location visit others in a different location with a specific theme of study in mind for example tackling a soil conservation problem and *Striga* weed management. In this regard, farmers in the problem area visit their counterparts who have greater experience in managing the problem. Therefore, FEVs form an important component of implementing agricultural research and development programmes in Tanzania.

2.3.10 Community theatre

Community theatre is a participatory theatre technique intended to stimulate critical thinking for positive change. It has widely been applied in Tanzania, Kenya and Uganda on various political, economical and social activities. As a technique it has proved to be one of the most effective medium of communication with the power to sensitise people so that they can effectively change their situations (Bakari, 1996). Bakari (1996), observed that people's participation is the best way of ensuring that plans and decisions are executed by the people themselves for their own development. With this technique the audience is taken in various experiences, which relate to their real life and during those experiences, they identify problems, try out solutions, and discuss plans for

change. In other words, people train themselves for real action and action is a result of stored experiences between performers and the audience.

Bakari (1996) further observed that the community theatre technique differs very much from the mysterious conventional theatre of the audience-performer separation in which people are told what to do and what not to do. As a learning method, it bridges the gap between artists and audiences as the two parties both enter the dialogue, identify problems together and find out the best solutions.

2.3.11 Summary of extension approaches.

The learning approaches reviewed on the previous sections have one thing in common, that is the participation of local people in the whole process of learning and technology development, except for T&V which is based on transfer of technology model and its bureaucratic protocols. This shows the essence of local peoples' knowledge in sustaining programmes such as *Striga* control as well as adoption of the new measures. It indicates that farmers learn effectively when they are made part and parcel of the process. However, it is not ideal to dictate the most plausible method for use in Tanzania, because the key issue is participation of the grass root society hence the method, which render to maximum participation can be chosen. Therefore the methods can be used singly or in combination depending on situations upon which researchers are working in.

2.4 Status of *Striga* research in Tanzania

The UK Department for International Development has supported research on development of *Striga* control measures for a number of years. The endeavours have led to an improved understanding of the biochemical and physiological processes, which are at the heart of the host/parasite association (Riches, 1999). It also allowed the development in selection of *Striga* resistant crop cultivars.

Studies have been undertaken both on station and on-farm in the Lake, Central and Southern Highlands agricultural zones of Tanzania, in areas where sorghum, finger millet or upland rice are infested by *Striga* (Mbwaga, 1996; Mafuru, 1999). Between 1988-1996 efforts were made to survey the distribution of *Striga* in Tanzania, to examine host preference, evaluate susceptibility of sorghum cultivars and to assess the value of cultural practices including intercropping, manure and fertilizer use in research managed trials (Mbwaga, 1994; Mbwaga, 1996).

Strategies have been to form farmer research groups (FRGs) whose members have attended meetings to discuss biology and control and who have planted a series of trials on their fields. These have assessed cultivars and management interventions (Mbwaga, 1996).

Farmers involved in the research process learnt how to participate more effectively and researchers learnt more about farmers' perceptions of *Striga*. Socio-economic research inputs were essential to build rapport and better understanding of the complex livelihood system of the target research areas (Mwanga, 2002 personal communication). The socio-economic studies have been undertaken by the project and necessary contribution has been provided by the District Extension Office.

However, despite all these efforts, it has been noted on the problem statement and in section 2.3 that farmers, some extensionists and other stakeholders have very little understanding of *Striga* biology. This motivated the study to review various extension approaches and to evaluate learning tools so as to recommend the effective channels of communicating *Striga* biology to different stakeholders and hence contribute in fighting the witchweed. Furthermore, the study is intended to assess stakeholders' knowledge of *Striga* biology and management as well as stakeholders' training needs and factors influencing the application of knowledge in the fight against witchweed. The purpose is to increase cereal productivity and hence to ensure food security in Tanzania.

This chapter has described concepts of learning and learning approaches. It has briefly provided the definitions and explanation of effective learning and how it is measured. The chapter offered a comparative review of transfer of technology and participatory technology development models. Ten extension and learning approaches have also been

reviewed. The final section presented the status of *Striga* research in Tanzania. The next chapter will provide the methodology of the study.

CHAPTER THREE

METHODOLOGY

3.1 Overview

This chapter describes the study area and methodology employed in the study. Section one provides the description of the study location, its geographical characteristics and the reasons for its choice. In section two the sampling design is described while section three outlines the data collection method. Section four gives a brief note on data processing and analysis. Section five provides the limitations of the study and finally section six gives the summary of the chapter.

3.2 Study Location and Justification for its Selection

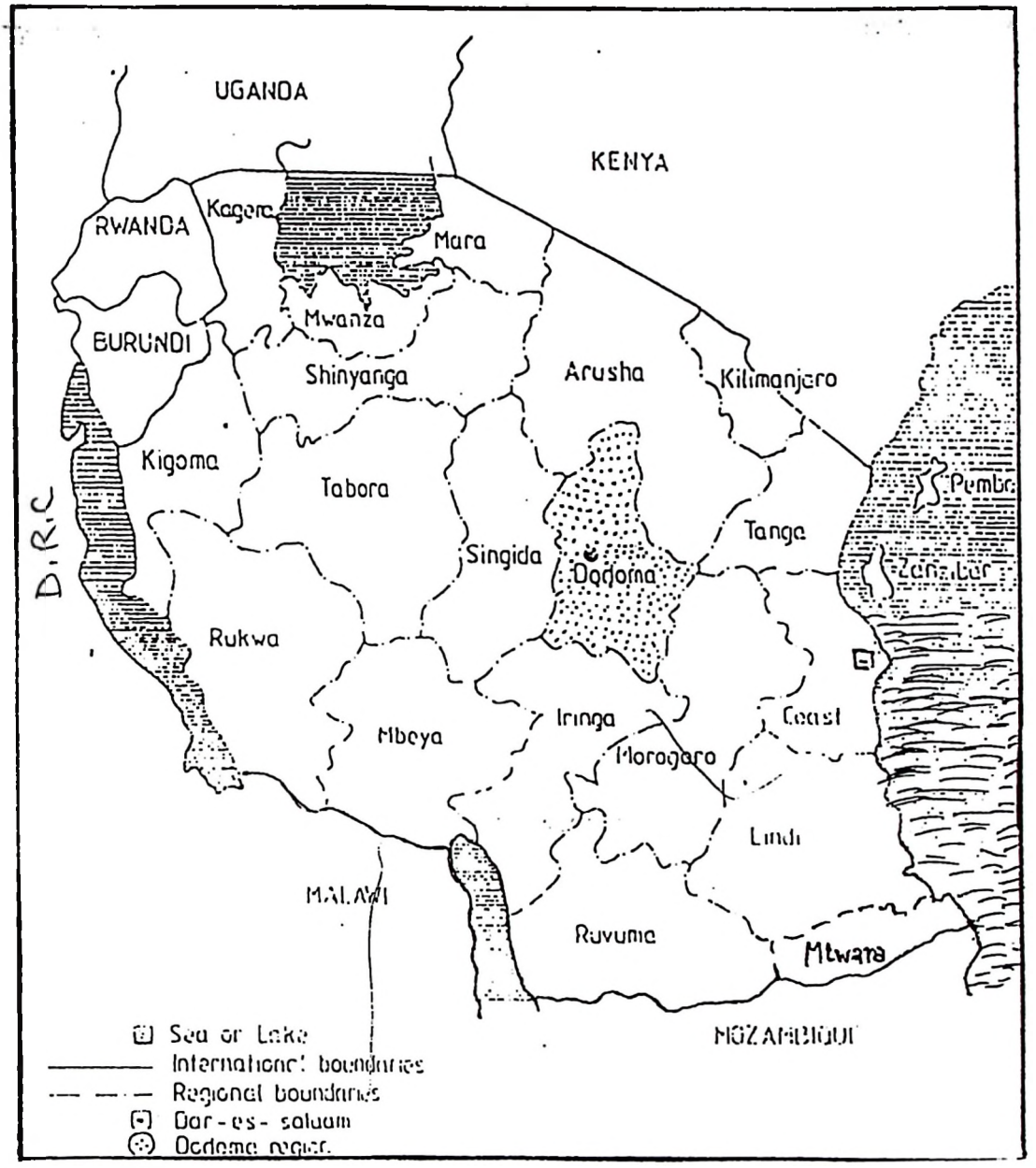
This study was conducted at Mvumi Makulu and Chipanga 'A' villages in Dodoma District, Dodoma Region. Dodoma Region is located in the central plateau of Tanzania extending between latitude 4° and 7°30' south and between longitude 35° and 37° east. The Region covers some 41,372 square kilometres or five percent of the total land area of Tanzania Mainland (URT, 1994).

Dodoma Region is bordered by six regions as shown in figure 1 (but Manyara Region is not marked since it was recently formed). It has four rural administrative Districts and

one municipality. These are Kondoa, Mpwapwa, Kongwa, Dodoma and Dodoma municipality (Figure 2). The major ethnic groups are Bantu speaking people. These include Wagogo, Warangi, Wanguu, Wazigua, Wakaguru and Wasagara. Kiswahili is widely spoken in the Region.

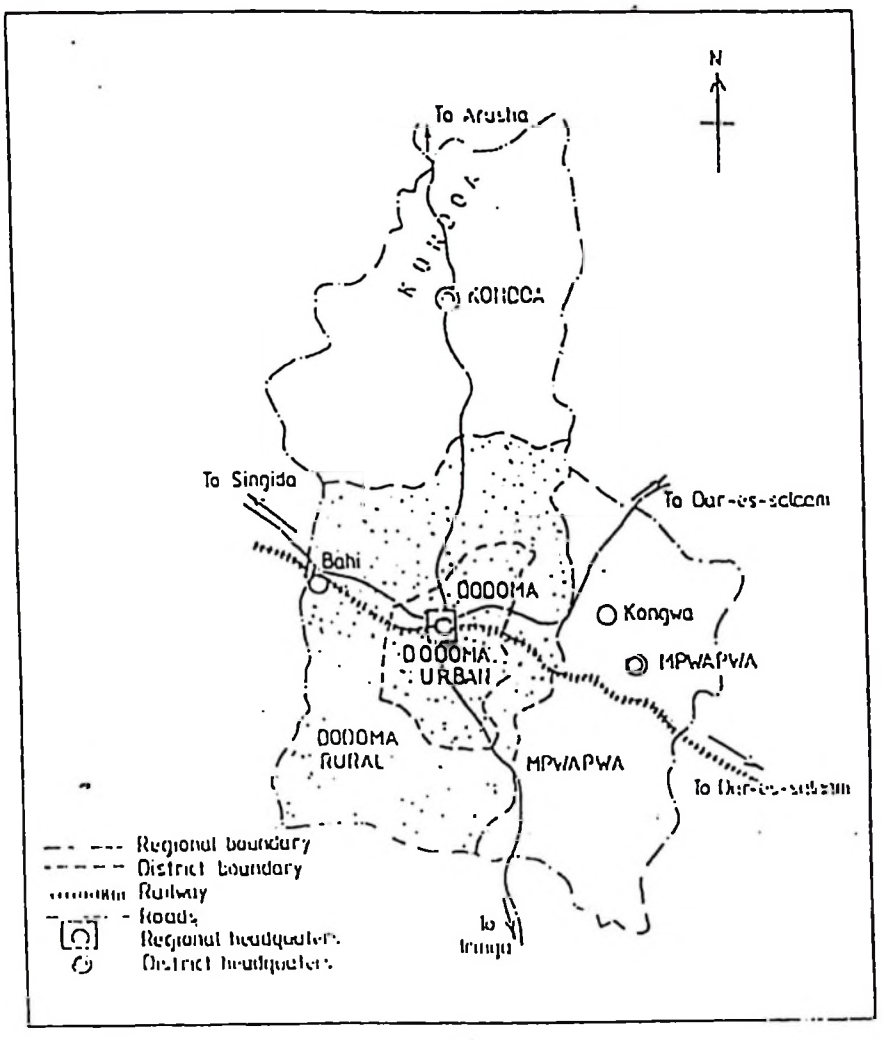
Dodoma Region lies at about 1040 metres above sea level (m.a.s.l). It has a savannah type of climate characterised by seasonal rainfall distribution with long dry spells from late April to early December. It has a short single wet season from early December to the end of April (URT, 1997). The growing season for rainfed annual crops is confined to the six months of December through May. The average rainfall ranges from 400 mm to 900 mm throughout the Region with rainfall amounts being related to topography.

Temperatures in the region vary according to season and altitude but generally range between 10°C and 35°C. The major activities are agriculture and livestock keeping. The type of crops grown correlate with the rainfall pattern and the topography. The dominant crops being maize, sorghum, millet and groundnuts. Others are cowpeas, bambara nuts, paddy and sweet potatoes. Dodoma Region was chosen for the study because the DFID-CPP *Striga* control project had been operating since 1988, therefore there is significant number of contact farmers in the project. Furthermore, the nature of the study required regular visits to the study area and hence Dodoma, which is nearer to Morogoro, was chosen.



Source: Capital Development Authority (1976).

Figure 1: Map of Tanzania: Regional boundaries



Source: Capital Development Authority (1976).

Figure 2: Map of Dodoma Region: District boundaries

3.3 Research Design

The research was a cross-sectional study in which a triple phase survey involved FGDs, in-depth and key informants interviews was conducted. The design was chosen because it is suitable for a study in which data for a single year are considered (Cooksey and Lokuji, 1995), which is the case of this study.

3.4 Sampling Design

3.4.1 The population

The population, from which the sample for this research was drawn, was all farmers involved in on-farm trials in the *Striga* control project. These were from Mvumi Makulu and Chipanga 'A' villages. The farmers were members of FRGs listed on the village extension office. FRGs members have attended several seminars conducted by the DFID-CPP *Striga* control project. Others involved were SUA undergraduate students of degree programme that took a course on weed management. These are 3rdyear Bachelor of Science (BSc) (Agronomy), 3rdyear BSc. (Horticulture) and 4th year BSc (Agriculture General). Researchers from Ilonga ARI, trainers from IFTz, extension staff at village and district level were also included in the sample.

3.4.2 The Sample

The farmer researchers were selected based on non-probability objective sampling design. Every tenth farmer was picked from the list provided by the village extension staff, starting with the first in the list. The design was convenient due to its relative advantage in resource saving especially time and money (Goon *et al.*, 2001).

A multi-phase sampling technique was used (Moser and Kalton, 1973), as 80 farmer researchers were engaged in the focus group discussion in the first phase where farmers' knowledge, perception and learning tools (rhizotron, pot experiments, theatre and printed materials consisting of posters, leaflets, working papers and a manual) were evaluated using the FGD guide (Appendix 1). The learning tools were chosen for the reason stated previously (section 1.2). Forty farmers were from Mvumi Makulu and the other forty were from Chipanga 'A'. The groups comprised of 10 persons each and were constituted on the basis of age and gender. There were youth groups and middle-aged groups, with ages ranging between 19 and 63 years.

The second phase consisted of in-depth interviews with farmer researchers and other stakeholders. This was necessary since more information was required to complement FGD data. Forty two farmer researchers were contacted and interviewed individually in this phase, twenty-one farmers were from Mvumi Makulu and the other 21 from Chipanga 'A'.

The other stakeholders comprised of six Sokoine University of Agriculture students, one Zonal Communication Officer, four extension officers from Dodoma District and two Trainers from IFTz who were involved in the key informant interviews during the third phase based on the checklist (Appendix 3). Key informants were selected based on a purposive sampling technique as leaders of respective organisations or departments named the persons following the convenience of their work schedule.

The students who participated were representatives of their degree programmes, who took a course of weed biology.

3.5 Data Collection Methods

Initially a visit was made to familiarise the researcher with the farmer researcher groups at Mvumi Makulu and Chipanga 'A'. On this trip, the rhizotrons and pot experiments were set. The rhizotrons and pot experiments were planned to be set in three cycles depending on farmers' participation but only one cycle was successful at Mvumi Makulu because farmers did not like the school like procedures the experiments based on. The rhizotrons and pot experiments were demonstrated to farmers and evaluations done after six weeks. Also other learning tools mainly printed materials like posters and leaflets were distributed to the villages so that farmers and other stakeholders had enough time to read them for evaluation at a future date.

A series of focus group discussions were carried out later on where knowledge and learning tools were evaluated. The FGDs were facilitated by the researcher who also was taking notes during the FGDs proceedings. The FGDs followed a guide (Appendix 1). After compilation and analysis of FGD data, still there was the need to undertake in-depth interviews so as to uncover information, which was not obtained through the FGD exercise. There was also need to see if different information could be drawn compared to the FGD.

The in-depth interviews were carried out with farmer researchers and involved visiting their *Striga* trial plots. On these visits some farmers were asked to draw plans/ sketches of their fields on the ground, to explain the practices they were doing, why they were practising and from whom they had learnt the practices (Table 1). Appendices 5, 6 and 7 provide the sketch of farmers' plots.

Some farmers were gathered in groups comprised of males and females to perform pairwise ranking of sources of information (Appendices 8 and 9). The same guide applied on FGD was used with an addition of aspects concerning radio and *Striga* trial plots. The data collection was concluded with the key informants' interviews using a checklist (Appendix 3). The key informant interviews, in-depth interviews and FGDs were necessary phases in this study as the whole exercise required information from various groups of stakeholders (extensionists, researchers, farmers and NGOs).

3.6 Data Analysis

Responses and proceedings of the focus group were recorded. The cut and paste analysis (Stewart and Shamdasani, 1990) was used to select the relevant information from various stakeholder groups which was compiled forming the results and discussions chapter. The same approach was used for the information obtained from key informants and in-depth interviews.

Pairwise ranking was used to rank the sources of information according to the criteria discussed in Chapter Four. This exercise was performed by a group of men and women in each of the two villages. Statistical Package for Social Sciences (SPSS 9.0 for Windows) was used to analyse the quantitative data and to obtain frequencies concerning the evaluation of radio as a learning tool.

3.7 Limitations of the Study

The two villages Mvumi Makulu and Chipanga 'A' are very far from each other. Hence more time was spent on shuttling between the two. During rainy season the roads were impassable posing a serious transport problem. The farmers' on-farm trials were very scattered. This limited the number of farmers visited on one day and hence took more time to visit the trials.

The farmers were engaged in other projects like the IFAD irrigation project and Dodoma rural roads maintenance project. This caused difficulties in meeting farmers for FGDs and in-depth interviews.

This chapter has described the study location and justified its selection. The research design, sampling design and methods of data collection, processing and analysis are fully dealt. Finally the chapter gave limitations faced when undertaking the research. The results and discussion of the data collected are presented in the following chapter.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Overview

In this chapter results from focus group discussions, in-depth interviews and key informant interviews are presented and discussed. Respondents' characteristics, farmers' knowledge of *Striga*, their sources of information, perception of the *Striga* problem, usefulness of knowledge and factors influencing the use of knowledge are presented. The training needs of farmers and other stakeholders have also been presented. On the last part of this chapter various learning tools (rhizotrons, pot experiment, printed materials, radio, theatre and on-farm trials) have been evaluated basing on different stakeholders' criteria.

4.2 Respondents' characteristics

Eighty farmers were involved in FGD, forty farmers from each village. The groups comprised of 10 persons each, where 20 males and 20 females were participated in both Mvumi Makulu and Chipanga 'A'. There were youth groups and middle-aged groups with ages ranging from 19 and 63 years.

Most farmers were primary school leavers completed standard four and seven respectively, while some had attended adult education. Also forty-two farmers were

involved in in-depth interviews to complement information of FGD, where by 21 farmers were from Mvumi Makulu and other 21 from Chipanga 'A'. The same farmers (from FGD) were contacted given equal opportunity for male and female farmers.

Key informants contacted were undergraduate students from SUA. Others were four extension officers from the District office (3 males and 1 female with age ranging 35 and 45, with diploma level in agriculture). While the two trainers were from IFTz (1 male and 1 female middle aged with bachelors in agriculture and sociology respectively).

4.3 Local Knowledge of *Striga*

Farmers in Chipanga "A" and Mvumi Makulu village have known *Striga* since colonial times. In-depth interviews followed by key informants probing show that these weeds existed long before independence. This was similarly reported by Mbwaga *et al.* (2000). Farmers perceived *Striga* as good plants with attractive red flowers (*Striga asiatica*), which were suited for decorating their surroundings.

Some farmers called *Striga* '*vidung'u*' *(in Kigogo)*, something that strangles cereal crops (sorghum, millet and maize) and causes it not to move along (not to grow); hence they become weak with low yields. Other farmers went further and called it '*malawila*', comparing *Striga* to the foot and mouth disease of cattle and goats. This

means that when these weeds are established around cereal plants, they create wounds on the plant mouth (like in goats and cattle) hence preventing it from walking (meaning to grow) and to eat (absorb nutrients from the soil), therefore becoming weak and yielding lower or sometimes dying. Mbwaga *et al.* (2000), had similar findings that *Striga* is given special names in different tribes, which are associated with its damage to the crops and nature of the attack, which is considered mysterious.

Farmers described *Striga* as being prevalent in sorghum, millet and maize fields, which are located in sandy soils (*isang'a*). *Striga* is also found in fields with *mwilolo* soils which are along the river banks with mixture of sandy and dark soils (*ngogomba*) and in *ng'huluhi* (red soils). In-depth interviews with visits to farmers' fields revealed that *Striga* is found in places with low soil fertility and where soils are conducive to harbour it. Lamboll *et al.* (2001), had also reported that *Striga* is associated with poor soils and found in all types of soils. Farmers said that *Striga* can be seen in farms of women, men, poor and even rich people and it is reported as a problem to everyone.

However, key informants contacted, perceived *Striga* as attributed to the use of contaminated seeds from infested fields, and to leaching and run-off effect resulting from the land preparation system commonly known as '*kuberega*', which involves slashing followed by burning then sowing of seeds, with no tilling of the land. In fact, this practice has led to loss of soil nutrients in the form of ashes taken by run off water. The other perceived cause is lack of alternative crop to grow because the semi

arid nature of the area leaves farmers with no option but to grow sorghum every season.

Focus group discussions showed that traditionally, *Striga* is controlled by uprooting and hand hoe weeding, then leaving it in the field to dry, as *Striga* is not easily burnt when it is still green. Some farmers used to leave the heavily infected fields and open new ones (fallowing).

As one farmer said '*formerly I used to grow maize in my field, but suddenly I was surprised to see the whole field has this plant (Striga) and my crops couldn't grow, I decided to leave the farm and find a new one, but when I saw the extension officer, I was told to grow groundnuts instead of maize and now I get good groundnut yields and I am reconsidering planting sorghum next season*' (middle age, male, Mvumi Makulu).

However, in-depth interviews of farmer-researchers revealed that farmers have learnt new methods of controlling *Striga*, popularly known as integrated *Striga* control. These include farmyard manure (FYM) application in fields where cattle are kept. Others are crop rotation, mixed cropping and the use of resistant strains like P9405 as well as herbicides application (2-4D-amine), although none of the farmers were found applying these methods within their fields. These remained in small (*Striga* trial) plots. The reason for this is the mismatch between the methods (technology) and the farmers' socio-economic conditions. The study by Debrah (1994) in Mali

also concluded that the lack of economically feasible and effective technology in *Striga* control have led to farmers not adopting the new innovation.

4.4 Sources of Information on various Agricultural Practices

Farmers in Mvumi Makulu and Chipanga 'A' identified various pathways of agricultural information and messages. These include research, extension, family (parents and relatives), neighbouring farmers, distant farmers (farmer exchange visits), NGOs as well as own initiatives (Table1). Other studies by Otieno-Oruko *et al.*, (2000) and Lamboll *et al.* (2000), reported similar findings in Kenya and Uganda respectively.

During a pairwise ranking of information sources, farmers in Mvumi Makulu ranked parents and relatives (family) the first on the basis that they are the closest of all, interactive and practical (employ learning by doing) compared to other sources. Research, extension and NGOs were ranked second because they are modern and provide reliable information. Neighbouring farmers were ranked third among others while own initiatives were ranked fourth (Appendix 8).

Farmers in Chipanga 'A' ranked the sources differently compared to farmers in Mvumi Makulu. They ranked farmers exchange visits (distant farmers) as the first one on the basis that they can learn many things from fellow farmers. Moreover it is more interactive compared to other sources. Extension was ranked second because it is closer and provides reliable information although there were few numbers of

extension staff covering many villages. Own initiatives ranked third on basis that this was closer and most personal which can generate technology by experiential learning. Research was ranked fourth because farmers consider it as being the furthest source of information compared to others. Family (parents and relatives) was also placed fourth on the list. Family was perceived to be the most traditional way of passing information, interactive and one can learn valuable practices in the course of living (experiential learning). Neighbouring farmers were ranked fifth and last (Appendix 9). Farmers in the two villages ranked the sources differently due to the difference in perception of the criteria used on ranking exercise.

4.5 Farmers' Perception of *Striga* problem

Farmers and other stakeholders (researchers and extension staff) understand *Striga* as a dangerous weed that is responsible for yield reduction in their fields and a cause of land devaluation to a great extent. *Striga* in these places is a problem, because most farmers are still controlling it traditionally by uprooting and hand hoe weeding. Mbwaga *et al.*, (2000) had noted this as a common control measure, but when the fields are larger, it is impossible to control it effectively as too much labour is required. This has led to the increase of *Striga* year after year as farmers grow the same crops in the same fields every season. Mafuru (1999) had noted the same trend of *Striga* increase in the Lake zone.

Table 1: Farmers' Stated Sources of Information on Various Agricultural Practices

Practices	Why?	Source of Information
Majaribio(*Striga* trials)	Testing seeds resistant to *Striga*, seed multiplication, and it's a classroom for other farmers to learn.	Researchers i.e. ARI, NRI and SUA, Extension
Locating trial plots near the village path	Other farmers could see and learn	Own idea
Houses and kraal built at the centre of the farm	Security purposes i.e. theft	Parents and relatives
Applying animal manure in field	Improving soil fertility	Extension and parents
Planting local varieties	Can be stored in long time, taste good and have good straws	Own idea, family (parents and relative)
Smearing a plot with animal manure	For threshing sorghum	Family and neighbouring farmers
Planting pure stand crops e.g. grundnuts, sorghum	Maximize yield and reducing working time	Extension and family as well as own idea
Mixing crops and fruit trees in one field	Have large plots, provision of shade in sunny days and fruits for selling and use at home	Family
Making ridges	To conserve moisture	Extension and seminar
Planting sisal against water flow	Retaining water in the field when it rains	Study visit (farmer exchange visit) Mpwapwa
Planting/leaving trees in the field	Getting handles for hoes, medicinal purposes animal feeds and rope extraction and for building purposes	Family, researchers and extension
Keeping cattle in a shade or tethered	Conserved area under HADO may get penalized if allowing them astray	HADO

Source: Dodoma survey, 2002

4.6 Factors Influencing Application of Knowledge

Practically all FGD members in the two locations (Mvumi Makulu and Chipanga "A") were aware of *Striga* and the damage it causes, except for the few people who were not members of FRGs.

In the discussions, FRG was taken as an example of a process through which knowledge is generated. It is regarded as a potential instrument in improving cereal productivity and sustainability of smallholder farmers, as it imparts the farmers with lessons on how to carry out experiments and solve problems within their own context. Various factors were identified as driving forces for the farmers to join FRG or for applying other forms of knowledge. These were personal, socio-cultural and economic factors.

4.6.1 Personal factors

Some farmers have an intrinsic spirit to make a difference compared to others. These farmers want to test any technology brought to them at any cost regardless of the risks the technology bears.

As one farmer said *'I am ready to participate in any of the on-farm experiments, see I have a large plot, but what let me down is the rain, it was very scarce around here and the pests (army worms-Spodoptera exempta) destroyed my crops every season*

and since I knew about OFR I am optimistic this is the right path to the solution of our problems' (Youth, male, Mvumi Makulu).

For instance, a study in Bungoma by Juma (1987) noted that farmers are experimenters by nature. They continually try out and adjust their practices in response to changing environment. This is an individual characteristic.

4.6.2 Social-cultural factors

Traditionally, farmers used to work together in groups. This way they could help one another with the land preparation, planting, weeding or seeds. It required no payment but one could prepare local brew and invite others to come and work in his/her farm. Then after work they sat drinking together and in addition one could gain wisdom from other experienced people working together.

Farmers believed that in working together on many of their problems, they got one voice and this way they could even influence some changes in their villages for example some decisions in village meetings (political powers gained). There is a popular Swahili saying that 'one finger cannot crash the lice'. Therefore on this ground, farmers were obliged to work in solidarity. Socio-cultural factors did not significantly affect the use of knowledge (Chagaka, 1998). But the author argued strongly that, the factors could not be ignored as important attributes influencing the adoption and use of knowledge by farmers.

4.6.3 Economic factors

Economic factors are the major driving force for the farmers to apply knowledge, as majority of FGD members show great desire on utility maximisation. Therefore the reasons for them to join FRG were hooked on the fact that they thought of yield maximisation (yield increase), which is backed by the free technical advice they got from researchers and extension officers, for instance, on uses of farmyard manure, planting in straight lines and proper spacing. Inputs provision like the resistant and early maturing seeds (Macia, P9405, P9406, Pato), herbicides and regular seminars were other benefits obtained by belonging to FRG. As one farmer reported that '*I joined FRG because I am getting the best advice from the researchers and extension staff. Also they provide us with good seeds which mature early and are easily marketed (macia)* '(middle age, female, Chipanga 'A').

Despite the occurrence of frequent hunger, farmers appreciated that they gained something through these FRG efforts. As one person said *'I am getting something here though very little. Now I have recognised that knowledge is wealth as I am seeing the changes in my daily livelihood improving strategies'* (middle aged, female, Chipanga 'A').

A study at Uluguru Mountains Agricultural Development Project (UMADEP) by Nombo and Mattee (1998) also noted similar findings, that farmers joined groups mainly because of the benefits, which could be obtained from those groups. Also

Mtama (1997) and Mandara (1998) had identified economic attributes as the driving force of farmers on the application of knowledge.

4.7 Training Needs

FRG members and village extension officers have shown greater understanding and knowledge on the biological nature of *Striga* as well as its management aspects. Much work remained to be done for those who are not FRG members that include youths, school children and other village officials, who could play a part in raising awareness concerning *Striga* among themselves and the people in general. During discussions, some non-FRG members expressed an interest to be taught about the parasitic nature of *Striga* and its management practices. Farmers are ready to join in groups so that they are given seminars concerning the nature of *Striga,* the whole issue of integrated *Striga* control and farmer-researcher groups formation in order to participate in the searching of a sustainable solution of this weed.

Youths were of the opinion that, sometimes it is advisable for researchers and VEOs to visit the village and conduct meetings for the whole village, to explain the importance of FRG to different groups of people regardless of age or sex. This is because if the idea is spread only to male elders it becomes difficult to trickle down to other groups like female elders, youth (girls and boys) and school children, who are expected to carry out agricultural activities in future. Technologies developed in small trial plots, will disappear at the end of evaluation/experimentation. Furthermore, some youth groups, especially girls expressed a need to be taught about integrated *Striga* control as a group separate from boys (men), because men had been

exposed/taught for many years but they never passed the information to others effectively. One girl was quoted as saying that *'we were left behind, we need to match at the same pace as men and perhaps we can do better than men'* (youth, female, Chipanga 'A')

Some farmers who are in the FRGs argue that, in one of the methods of controlling *Striga,* they have been told to rotate or sometimes intercrop other crops with pigeon peas (a legume). These peas were heavily attacked by insects (termites) and they got nothing at the end. If they get some yield, they cannot use them because pigeon peas are new to them and do not taste good when cooked. May be they should be given training on how to use this legume (like it has been done for cassava),or perhaps an inclusion of this aspect in women programmes would help the adoption of pigeon peas and other crops, which are useful components of integrated *Striga* control approach.

Apart from this, farmers in Mvumi Makulu and Chipanga 'A' have shown greater interest on the use of herbicide and/or pesticide. Therefore they suggested that they should be taught on how to use these chemicals in their fields. In-depth interviews showed that most of the farmers are enthusiastic to see how farmers in other places control *Striga.* They had suggested to have farmer exchange visits to the areas where farmers have succeeded on *Striga* control so that they can copy from them. TARP II-SUA (2001) had expressed similar views for effective technology development in general.

Key informants contacted revealed that, most of the field extension officers who are in the forefront on the battle against *Striga* (they are the closest people to farmers) had little knowledge about the weed. They could not explain the biology of *Striga*, its mode of infestation, spread and crop damage associated with it. Mbwaga and Obilana (1993); Mbwaga (1994), and Mbwaga (1999), noted that, some typical symptoms caused by *Striga* such as stunted growth, leaf scorching and wilting of crop plants were defined by extension officers to be associated with poor soil fertility, crop management or drought.

There is an immediate need to train extension officers on this problem through seminars and workshops. Furthermore, it had been argued that the project should involve extension officers from other places and not only from the project areas, such that when those in *Striga* stricken sites are transferred to other places or retired it will be possible to replace them with those who are already knowledgeable about *Striga*.

4.8 Evaluation of Learning Tools

4.8.1 Rhizotron and Pot experiments

Rhizotrons and pot experiments are devices usually used by researchers in research centres. These instruments enable them to observe the effect of *Striga* on cereals. For instance the rhizotron displays a real picture of what is happening underground before emergence of *Striga* (Figure 3) and after germination while the pot experiment reflects the situation in the field. The tools have been regularly exhibited in seminars and agricultural fairs to raise awareness and aid in the understanding of

Striga. *Materials*: The rhizotron obtained from Ilonga ARI, black bin-liner, file clips, tape and bloating paper. Pots were of two types, the transparent pots and non-transparent pots, soil, water, sorghum seeds and *Striga* seeds.

Method: The rhizotron and pot experiments were set under farmer conditions with the help of the Village Extension Officer (VEO) and facilitation of the researcher. The first, step was to decide on the name of the rhizotron in local language. Majority of farmers decided '*Kilole cha viduhi*' implying the viewer of *Striga*. It was also agreed that these experiments, have to be managed by farmers themselves (like watering and planting), and they should be placed at the VEO's house/office. This would enable/trigger the process of experiential learning/learning by doing on the farmers' side.

The researcher had been visiting the research sites regularly to monitor the development of the set experiments (but cautiously not to do it himself to influence the farmers thinking that the experiments were not meant for them but for him and the extension officer). After six weeks the farmers had been shown the outcome of the experiments and the tools had been evaluated according to farmers' criteria. At this experiment, no experimental design or statistical analysis was required. It was meant for demonstrating farmers.

Figure 3: A typical Rhizotron set at Mvumi Makulu.

Target groups: Rhizotrons and pot experiments are forms of formal experiments meant for researchers, extension officers, school teachers, college and university students as well as college/university tutors.

Purpose: It is the fact that farmers lack the knowledge of the biological aspects of *Striga*, which is considered as the basis for combating the weed. This fact had been the driving force of borrowing the research-based way of learning and using it for farmers.

The assumption is that, when farmers are directed/facilitated on how to manage the rhizotrons and pot experiments, they would be able to observe themselves with the help/facilitation of a researcher how *Striga* behaves underground before germination and after germination. They would also be able to compare the situation on pots with what is really happening on their fields. This way they can develop an inquiring mind, which may result into solutions and strategies on how to control *Striga* by self-discovery.

Observation: The first impression was that farmers in Mvumi Makulu and Chipanga 'A' were very much attracted by the pots rather than the rhizotron. They suggested the pots to be given to them so that they can use for keeping salt, sugar and cereal flour for household as well as for selling local brew at the local pub. Therefore making holes on the pots to allow water movement was considered to be waste of resources by majority of farmers.

Participation of farmers at Mvumi Makulu was very positive at the time of setting the experiments. Although, they did not manage the experiments and left them to the village extension officer to take care. At Chipanga 'A' very few farmers turned out and most of them complained that they did not have time to water the experiments, because water is scarce as they had to fetch it from long distances. At the end, Mvumi Makulu farmers managed to see the results that *Striga* starts germinating underground before it emerges above ground. Later on the germinated *Striga* died as it failed to compete with the resistant sorghum strain P9405. At Chipanga 'A' they

could not see it because they did not water the experiments and therefore the seeds never germinated.

Some farmers expressed their concern that they did not see the rhizotron and pot experiments, as useful activities. They would rather have had solutions to curb the *Striga* problem. Some farmers lamented to be taken to school at their old age as they were quoted as saying "*hii shule sasa*" meaning "this is school now". This is an indication that farmers were uncomfortable with the school like protocol.

4.8.2 Printed Materials

Various printed materials have been used in the project for raising awareness as well as teaching different stakeholders (young researchers, extension officers, student and farmers) the biology of *Striga* and different ways of combating it. These include posters, leaflets and manuals (booklets) and field reports (Working Papers). These materials were collected from Ilonga ARI and evaluated by farmers at Mvumi Makulu and Chipanga "A". It should be noted that evaluation was based on the stakeholders' criteria and not on the researcher, therefore what is presented here is what farmers and extension officers think.

Figure 4: A poster on Integrated Striga Control

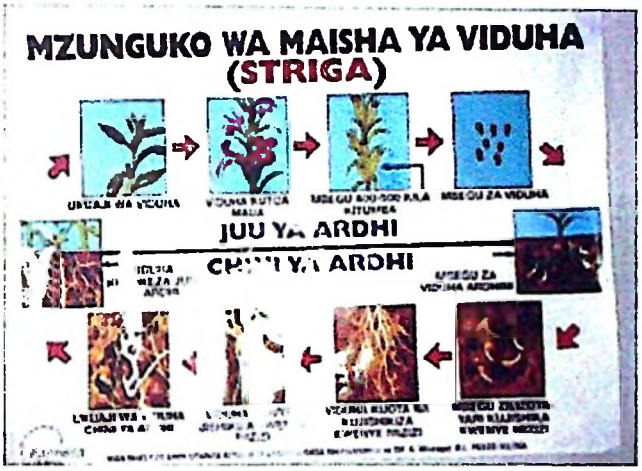


Figure 5: A poster showing life cycle of *Striga spp*

(a) Posters

Two Swahili posters were available (Figures 4 and 5), one poster was about the life cycle of *Striga* (prepared by Ilonga ARI) and the second poster was about Integrated *Striga* Management (prepared by Ilonga ARI and Department of Farmers' Education (DFE), Ministry of Agriculture and Food Security (MAFS). The target groups for these were farmers, extension officers, primary school pupils and their teachers.

The criteria for evaluation was language used on the posters, ease of understanding, time taken to comprehend the message, place where materials are available, availability of the materials themselves and ease of use.

Language: With respect to both posters, the farmers appreciated that the language was simple and well understood, because most of the farmers understand and speak Kiswahili fluently. *Ease of understanding*: The message on the posters was easy to comprehend since the illustrations are self-expressive and the language used was simple. (the posters showed daily experiences of farmers. They saw things they used to do/have everyday in these illustrations and therefore required no further explanation). *Time taken to comprehend*: In the presence of a moderator (extension officer and/or researcher), farmers expressed satisfaction that these posters cost them little time to understand as the language and the illustrations are easy and self explanatory.

Location where posters are placed: Some farmers, showed concern with the place where these materials are placed. For example, at Chipanga "A" these posters are available in the village extension officer's house and at the Ward Executive Office (WEO). The WEO's office is multipurpose, sometimes, it is used as a seminar room, meeting room but most farmers say it is used as a courtroom where farmers are fined and sometimes imprisoned. Thus, under normal circumstances this makes most farmers not to visit the place, hence can not have the opportunity to read these posters. Sometimes when called for a trial they see these posters on the wall but do not have time to concentrate and grasp the message from them but rather concentrate on the trial and on how to win it.

Availability of the posters: These posters are not available to the farmers and they are few in number. As one farmer reported *'we see them at the VEO's office/house and on the WEO's office. None of us have posters at home*' (middle age, Chipanga 'A'). An in-depth interview revealed that some farmers prefer to learn from pictures rather than words and hate to be treated as if they were in school. Farmers were complaining when asked to explain what the posters were all about. For example they used to say "*shule ngumu*"..."*shule hapa*". The former meaning "school is hard" and the later meaning, "It is school here", implying that farmers are uncomfortable with the school like environment.

(b) Leaflets

Two leaflets were evaluated during the survey. These were: -

(i) *Title of the leaflet*: "Fahamu gugu chawi (*Striga*) la mimea yako ya nafaka", (know the witchweed-*Striga* of your cereal crops). *Prepared* by Ministry of Agriculture and Food Security (MAFS), Department of Research and Development (DRD), Crop Protection Programme (CPP) in collaboration with Plant Protection Improvement Programme (PPIP). *Target groups* were farmers, extension officers, students and their teachers/tutors (Figure 6). *Aim*ed at raising awareness and imparting the biological aspects of *Striga* to the target groups.

Language: The language used was very simple, well understood in presence of a moderator (extension officer and/or researcher) as every farmer can speak Kiswahili fluently. *Clarity of pictures and font size*: an in-depth interview showed that farmers are very comfortable with pictures and complained that the font size used on the leaflet is too small to read. Also they argued that the pictures should be enlarged to fit the whole page. *Ease of understanding*: The message on the leaflet is easy to comprehend, as the words used are not difficult to understand. Also the illustrations are self-explanatory.

Time taken to comprehend: In the presence of a moderator farmers expressed satisfaction that the leaflet required little of their time to understand, therefore it is easy to use. *Availability of the leaflet*: Some farmers said it was the first time to see it displayed. Others appreciated that they had seen it in the seminars during FRGs

conducted in the village. The major reason why these leaflets are not readily available to farmers is that, they are few in number and usually not distributed to farmers.

Learning environment: Most farmers appeared to be uncomfortable with the school like environment. According to key informants contacted farmers learn best in informal environment. For instance farmers told to interpret the leaflet they started saying..."*shule ngumu*"or "*shule hapa*". Key informants further said that farmers are not learning alone always they learn in cooperation with each other that is one or two farmers may come across with the message and sit together with others in a group for further discussion.

(ii) *Title of a leaflet*: "Fahamu magonjwa ya Fugwe (smut diseases) na athari za kiduha (*Striga*) kwenye mtama katika Mkoa wa Dodoma", (know smut diseases and effects of *Striga* in sorghum in Dodoma region). *Prepared* by MAFS Tanzania and the Natural Resources Institute (NRI), Greenwich University, UK under DFID funding through CPP semi-arid projects. *Target groups* are farmers and extension officers. *Aimed at*: raising awareness and imparting the biological aspects of smuts diseases and *Striga* to target groups.

Figure 6:Typical leaflets evaluated at Mvumi Makulu and Chipanga 'A'

Language: The language used is very simple, well understood as every farmer can speak Kiswahili fluently. *Clarity of pictures and the font size*: an in-depth interview showed that farmers are very comfortable with pictures, although they complained that the font size used on the leaflet is too small to read. Also they argued that the pictures should be enlarged to fit the whole page.

Ease of understanding: The message on the leaflet is easy to comprehend, as the words used are not difficult to convey the intended meaning to the target persons. Also the illustrations are self-explanatory. However an in-depth interview and key informants contacted expressed concern that the mixing of two themes (smut and *Striga*) in one leaflet leads to confusion of target group. This may influence the audience to become less focused on the intended subject matter.

Time taken to comprehend the message: The time taken to comprehend the message is very short especially when there is assistance of the moderator (extension officer and/or researcher). *Availability of the leaflet*: Some farmers said it was the first time to see it displayed, others appreciated that they saw it in the seminars of FRG conducted by researchers in the village. Because these leaflets are not readily available to farmers and other stakeholders (such as students and primary school teachers). Furthermore they are not distributed to farmers although they are meant for them.

Learning environment: Most farmers indicated to be uncomfortable with the school like environment. According to key informants contacted farmers learn best in informal environment. For instance farmers told to interpret the leaflet started saying..."*shule ngumu*"or "*shule hapa*".

(c) Manual

Title: A reference manual on *Striga* distribution and control in Tanzania. *Authors*: Mbwaga, A.M., J. Kaswende and E. Shayo. *Target groups* are young researchers, university lecturers, college Tutors, university/college students, NGOs and extension officers as well as seed producers. *Aimed at*: Enabling the target groups to identify different species of *Striga*, their distribution and to understand other biological aspects of *Striga*. It is also meant to raise awareness of the socio-economics of this weed, so as to trigger an inquisitive mind, which can come up with appropriate solution for reducing risks of the weed to poor farmers or alleviate it if possible.

Language used is simple and easy to understand. *Ease of understanding*: The contents of the manual are very comprehensible and the illustrations are self-explanatory. *Time taken to comprehend:* Relatively short time can be used to comprehend what the manual intends. Especially for people who are conversant in field works because the pictures are well displayed and the illustrations are elaborate.

Availability of the manual: The manual is easily available at a cost of Tshs 2000/= and always found at the agricultural fairs every year. It can also be made available through correspondence by the Ilonga ARI Crop Protection Department.

(d) Working papers/ field reports

There were two working papers (WPs), which the researcher came across. The first WP was of 1999/2000 and the second one was of 2000/2001. The first WP was compiled by R. Lamboll and the second by R. Lamboll, J.P.Hella, A.M.Mbwaga and R.Riches. These WPs are produced and circulated by Ilonga ARI, NRI, and SUA. *Aim*: The WPs are produced with the purpose of providing preliminary results in order to encourage discussion and shape further research activities. *Target groups* were extension officers and researchers.

Language used is simple and easy to understand for researchers and extension officers but not to farmers. The reason is that all WPs are written in English and most farmers could not speak or understand English. *Ease of understanding*: The contents of the WPs are very comprehensible. *Time taken to comprehend:* Relatively short

time can be used to comprehend what is intended by the WPs especially for people who have been working with the project from the beginning. *Availability of the WP:* The WPs are circulated by project staff and are free of charge. Farmers do not have these reports because of the language barrier.

4.8.2 Evaluation of leaflets and posters from the scientists' perspective

Researchers, extension officers and students evaluated posters and leaflets on the basis of size (degree of largeness or smallness) of the materials, quality of paper materials are made of, presence of a logo indicative of donor supporting or implementing agent, clarity of visual impact of pictures/illustrations and ease of damaging as well as presence of contact persons' addresses and e-mails (if any) to facilitate communication in case of suggestions for improvement and/or clarification.

(a) **Leaflets**

(i)*Name of the leaflet*: "Fahamu gugu chawi (*Striga*) la mimea yako ya nafaka" (know the witchweed-*Striga* of your cereal crops). *Size of the leaflet*: It is large in size and this makes it difficult to handle, as it cannot be kept well in a bag. *Identity*: the leaflet has no logo. This makes it lack authority (the absence of organisational logo gives an indication that the problem is not as important as has been stressed).

Clarity of visual pictures: The pictures are very clear and the subject can be easily identified (perhaps this is the advantage of a large size). *Ease of damaging*: The fold

out is difficult to handle when reading especially on a windy day. In this way it can easily get damaged. *Address of contact persons*: The leaflet misses addresses and names of contact persons; this makes it difficult and inconvenient to communicate especially when a problem arises or when ordering copies of the leaflets.

Specificity of subject matter: It is focusing on one subject matter 'knowledge of *Striga* and its two common species in Tanzania which are *Striga asiatica* and *S.hermonthica* in this case it is easier for farmers and other stakeholders to recognise the predominant species on their area. *Font size*: the font size used is very small, and needs to be improved so that it is easy for the farmers to read. *Quality of the paper*: The low quality paper used may influence the perception that the subject dealt with is not as important as it has been emphasized. *Sequencing* (for Mchoro 1 and Mchoro 2) is not clear where to start, perhaps it is better to put clear numbering indicating where to start and where to end.

(ii) *Name of the leaflet:* "Fahamu Magonjwa ya Fugwe (Smut diseases) na athari za kiduha (Striga) kwenye mtama katika Mkoa wa Dodoma, (know smut diseases and effects of *Striga* in sorghum in Dodoma region). *Size of the leaflet*: It is small in size and this makes it easier to handle as it can be kept well in a bag. *Identity:* The leaflet has the NRI logo. This enhances the importance of the problem and justifies resource commitment in terms of funds and expertise to look for solution to *Striga*.

Clarity of visual pictures: The pictures have good colours, which attract the attention of the reader but are too small. There is a need to enlarge the pictures. Such that each

picture occupies the size of a page rather than inserting small ones to avoid confusion of what is the subject matter. *Ease of damaging*: Being smaller in size, the leaflet can easily be read in a windy day without damage. *Address of contact persons*: the leaflet has addresses and names of contact persons, who can easily be contacted in case of any problem and/or when ordering copies of the leaflets.

Specificity of subject matter: The leaflet has more than one subject matter i.e. smut and *Striga*, this makes the audience to lose focus on what is intended (for this aspect *Striga*). *Font size*: the font size used is very small, needs to be increased so that the farmers can read. Farmers are more comfortable with larger fonts. *Quality of the paper*: The higher quality paper used influences the perception that the subject dealt with in the leaflet is important and therefore influences reading what is inside. *Sequencing* (for Mchoro 1 and Mchoro 2 on page 7 and 8 respectively) is not clear where to start and further the diagrams are too small with words written in small fonts.

(b) POSTERS

(i) *Name of the poster 1*: "*Udhibiti husisha wa viduha*" (integrated *Striga* control). *Identity*: The poster has a logo of the organisation. This gives weight to the importance of the problem and justifies resource commitment in terms of funds and expertise to look for solution of *Striga*. *Clarity of pictures*: The pictures are very clear and show experience of farmers but it has no clear starting point. *Font size* used are large this makes it readable at a distance.

Addresses of contact persons: The posters lack contact addresses and names. This leads to inconveniences when there is a need for more clarification, suggestions or when ordering. *Specificity of the subject matter*: The poster is very specific on integrated control of *Striga*. Although the explanation is not enough for new readers perhaps the poster should be transformed to a leaflet and every diagram explained fully.

(ii) *Name of poster 2*: "*Mzunguko wa maisha ya viduha*" (the life cycle of *Striga)*. *Identity*: The poster has a logo of FARMESA indicating authoritative support on combating *Striga* in terms of resources (money, expertise). *Clarity of diagrams*: The picture is clear and the colours attractive to the readers, but does not have a clear starting point which is very confusing for new readers. *Font size*: The font size is okay, but there is need for more explanation on every stage of the cycle, perhaps it is better to transform it into a leaflet with each covered in one page accompanied by its explanation.

Contact address and names: The poster lack names and addresses of contact persons. This makes it difficult and inconvenient when ordering and/or in case of confusion as well as when suggestions have to be made.

4.8.4 Comr,unity theatre (drama, songs)

In the course of the discussions, FGD members were asked if they had ever attended or heard of community theatre (including drama and choir songs). The response from the majority was yes. They reported that they had already seen a variety of theatrical performances especially on the "Uhuru" torch ceremonies in their ward. Most of these performances were about HIV-AIDS education; also some were about awareness for Tuberculosis (TB), Trachoma and other health related matters like mother and child health. Some witnessed theatre performances on religious teachings.

When the national election is approaching community theatres are used for raising awareness on the citizens' right to vote and necessity of registering for the voting exercise. But there have not been any such performances about *Striga.* In theatres, farmers and other audiences reported that they are taken to their daily experiences, because things exhibited/used to express the message usually are common to their environment. In fact it is an effective way of learning as the audiences' (farmers, students, extension staff) experiences are used to express the message meant and sometimes the performers are their own sons and daughters. This makes the method simple and cost effective as the primary pupils or secondary school students usually do it.

4.8.5 Radio

An interview was carried out at Chipanga 'A' and Mvumi Makulu, 42 farmers, were asked if they possessed radios and 38.1 per cent said they possess radios. The remaining 61.9 per cent did not have radios. Out of 42 farmers only 33.3 per cent indicated that they had ever heard of agricultural programmes. About ten per cent agreed that they had heard about *Striga*.

Table 2: Farmers with radios, ever heard of agricultural programmes and those who have heard about *Striga* through radio (%)

Response	%Owned radio (N= 42)	%Heard agric.prog. (N= 42)	%Heard about *Striga* (N= 42)
Yes	38.1	33.3	9.5
No	61.9	66.7	90.5
Total	100.0	100.0	100.0

Source: Dodoma survey, 2002.

Most farmers indicated that they preferred to listen radio programmes during evening hours (4:00 to 6:00pm), because during daytime they are occupied with farm work and other activities. More than half (57%) of the farmers preferred to listen in the evening. About ten per cent of the farmers reported that they preferred to listen in the morning hours (7:00 to 11:00am), because they have a tendency of carrying their radios to the farms and whenever they are walking in the village. Thirty three per cent have a tendency of listening to radio programmes at night hours (7:00 to 11:00pm). None reported listening during afternoon hours (12:00 to 3:00pm) because most of them visit the local pub for relaxation after farm work. Others preferred to have a little nap and some complained that the radio programmes are heard with difficulty during daytime.

Table 3: Time on which farmers prefer to listen to radio programmes

Time of listening	%age of farmers who listen
Morning (7:00 to 11:00 am)	10.0
Afternoon (12:00 to 3:00 pm)	0.0
Evenings (4:00 to 6:00 pm)	57.0
Night (7:00 to 11:00 pm)	33.0
Total (N=42)	100.0

Source Dodoma survey, 2002

However key informants reported that various agricultural and rural programmes usually are broadcasted through the Radio Tanzania Dar es salaam (RTD) central zone (located in Dodoma), at around 5:15 pm twice a week on Mondays and Wednesdays. The programmes include health programmes, farm programmes (Kilimo Chetu), our village (Kijiji Chetu), drama on HIV/AIDS (Zinduka) and news bulletin. Nyamungumi and Mika (2001) on a survey in collaboration with Land Use Management Project (LUMP) reported similar findings in Singida Region. Most farmers were not listening to radio programmes because they do not have radios. Others have radios but cannot afford to buy batteries. For those who listen they preferred radio stations, which offer music rather than educational programmes.

4.8.6 *Striga* trials

According to the in-depth interview which was combined with visiting of various respondendets' farms in Chipanga 'A' and Mvumi Makulu villages, it was revealed that farmers had greater learning opportunity through the *Striga* trials. Most farmer-researchers exhibited greater understanding of what they are doing on the trials, as

they managed to explain the layout of the plots and the purpose of their trial just before any questions were posed.

Furthermore a thirty six year old woman had clearly explained the trials of her husband, insisting she was the one who prepared and planted the trials on behalf of her husband, although she was not in a farmer researcher group. Farmers learnt how to evaluate different sorghum varieties P 9405, P 9406, SRN 39 and Macia. They also test compatibility of various legumes with sorghum (bambara nuts, groundnuts, pigeon pea) in intercropping and the effect of animal manure on the control of *Striga*. The same has been reported by Lamboll (2000) and Lamboll *et al.* (2001).

Farmers appreciated that other farmers are visiting their plots to learn from them. Most of these farmers are coming from the two villages (Mvumi Makulu and Chipanga 'A'). Other farmers are coming from the neighbouring villages of Idifu, Ilolo, Mvumi Mission and Muungano (in the case of Mvumi Makulu). Others are from Chali, Nondwa, Chipanga 'B' and Chiguruka (in the case of Chipanga 'A').

Most farmers who visit are relatives, friends and/or neighbours of FRG members. The plots of the FRG members have impressed the visitors, although they find it tedious to copy the practices like planting in lines and proper spacing. Others said they had offered seeds to other farmers to try on their farms. The village extension officers confirmed that, the extent to which other farmers are trying what is taught on *Striga* trials can be seen especially for the new sorghum varieties at grain filling

stage and/or near harvesting time, when one can see many fields of macia, pato and others outside the FRG plots.

This chapter presented results and discussions from a series of focus group discussions, in-depth interviews and key informant interviews. The local knowledge of farmers, their perception and usefulness of knowledge and factors influencing the adoption and use of knowledge have been dealt with and compared with other studies elsewhere. The chapter also has explored the training needs of different stakeholders (farmers, extensionists and researchers). Furthermore learning tools have been evaluated on basis of different stakeholders' criteria.

CHAPTER FIVE

CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

In the previous chapter the major findings of the study were presented and discussed. The local knowledge, farmers' perception and training needs were assessed. Also various learning tools were evaluated as well. In this chapter a summary of the major findings of the study is presented, followed by conclusions and recommendations.

5.2 A summary of Major Findings

This study aimed at evaluating farmers' and other stakeholders' knowledge of *Striga*. It also assessed training needs for those stakeholders. Furthermore the study explored various factors, which have been influencing the use of knowledge. Learning tools were evaluated for their effectiveness in improving farmers' knowledge and understanding of *Striga*.

5.2.1 Local knowledge of *Striga*

Farmers in Chipanga 'A' and Mvumi Makulu have known *Striga* since colonial times. They had given it different names, *which* are associated with its damage to the crop and nature of the attack. These names include "*Malawila*" and "*Vidung'u*". Farmers also described various types of soils *Striga* is occupying and associated it with low soil fertility.

5.2.2 Sources of information on various agricultural practices

Farmers had identified several sources of information, which include research, extension, family (parents and relative), neighbouring farmers, distant farmers (farmer exchange visits) and NGOs. Farmers in Mvumi Makulu ranked parents and relatives (family) as the first and NGOs the last, while in Chipanga "A" farmers ranked farmers exchange visits as the first and neighbouring farmers the last. The villages emerged with different ranking due to differences in perception of the criteria used in the ranking exercise.

5.2.3 Farmers perception of *Striga* problem

Most farmers have reported that *Striga* is a problem to all farmers, provided that the conditions in the field are conducive to harbour it. It does not only attack fields of poor farmers, rather of all strata that is, poor, rich, young, old, male or female. Furthermore farmers and other stakeholders perceived *Striga* as a dangerous weed, which is responsible for yield reduction in their fields. Many farmers commented that the weed was on the increase.

5.2.4 Factors influencing the application of knowledge

Three factors were noted to affect the application of knowledge, these are personal, socio-cultural and economic factors. Most farmers reported to control *Striga* by use of hand hoe weeding and uprooting although they knew about other modern methods. This

is due to various socio-economic factors hindering them to apply the new methods, which they are taught in seminars and in *Striga* trials.

5.2.5 Training needs

A home economics component is highly required so as to influence farmers to adopt the use of legumes like pigeon peas. Also extensionists and new researchers need immediate training about the nature of *Striga* and its control measure. More seminars and workshops need to be conducted, and this should cover the whole range of extension staff in the research sites and those who are not on the research sites.

5.2.6 Evaluation of learning tools

Lastly various learning tools have been evaluated in the context of different stakeholders' criteria. It was learnt that no learning tool is superior to others in conveying knowledge to farmers, rather the suggestion is to use a combination of learning tools to land information to target groups.

5.3 Conclusions

The following conclusions can be made from the findings of this study.

(a) Farmers in both villages (Mvumi Makulu and Chipanga "A") have known *Striga* before independence. This can be proved by the manner in which *Striga* is given special names in different societies which connotes the damage on crops and its nature of attack. *Striga* is associated with low soil fertility and can be found in all

types of soils *Isang'a, Mwilolo, Ngogomba* and *Ng'huluhi*. It is perpetuated by use of unclean seeds (contaminated with *Striga*) and a tendency of growing similar crops in same fields each season.

Most farmers control *Striga* by uprooting and hand hoe weeding. Some who have enough land practice fallowing. But not a significant number of farmers were found applying manure, crop rotation and herbicides. This is due to the mismatch of the technology and the farmers' socio-economic conditions. Moreover farmers and other stakeholders perceived *Striga* as dangerous weed and understand it as being responsible for yield reduction in their fields. The weed had been noted to increase year after year.

(b) Several sources of agricultural information have been identified. These are research, family, neighbouring farmers, distant farmers (farmer exchange visit) and NGOs. Family and farmer exchange visits were ranked first compared to other sources. This indicates that farmers trust more their fellow farmers and can learn better through their colleagues.

(c) Three factors have been found to influence the use of knowledge and its adoption. These are personal factors, socio-cultural factors and economic factors. The most influential being the economic factors as farmers usually aim at profit maximization. They joined in groups because of the benefits sought.

(d) Training needs assessment had indicated that more farmers want to join in groups to enhance the possibility of getting seminars on the nature and biology of *Striga*. Farmers are eager to learn different ways of utilizing legumes for example pigeon peas. Furthermore, farmers want to see how farmers in other places are controlling *Striga*. There is also an immediate need to train extension staff on *Striga* and its biology through seminars and workshops accompanied by study visits. This should take care of extension staff within the project sites and those from other places because *Striga* still has a potential to invade other non-infested areas.

(e) Rhizotrons, pot experiments, printed materials, radios, theatre and *Striga* trials were the learning tools identified and adopted for teaching farmers and other stakeholders. The evaluation revealed that the project had never produced materials for farmers. Most of the present materials were meant for other stakeholders. It was also established that no learning tool was superior to another learning tool. The combination of various learning tools proved to be effective for the learning process. Rhizotrons and pot experiments were observed not fit for teaching farmers, as they were too formal experiments to farmers'learning environment. When used they bring a sense of schooling among farmers hence discouraging the learning process.

5.4 Recommendations

(a) There is a need to scale up a mechanism whereby farmers will be provided with clean seeds (free of *Striga*), fertilizers and/or soft loans. The loans will enable them to access these inputs and therefore enhance the adoption of integrated *Striga* control methods within their fields. Alternatively provide *Striga* control methods, which fit the farmers' socio-economic conditions.

(b) Make deliberate efforts to train farmers who have shown enthusiasm in participating in on-farm experiments, such that these farmers will become resourceful farmers who will assist others as trainers and moderators when the project is phased out. These farmers may become very good assistants of VEWs.

(c) Introduce a home economics component within the project framework, such that farmers will be taught various ways of utilising new crops promoted as *Striga* control measures for instance pigeon pea. Also effect farmer exchange visits to enable farmers experience how farmers in other places control *Striga.* This will trigger adoption of new methods as the farmers learn better from fellow farmers.

More workshops and seminars should be given to extension officers on the nature and biology of *Striga.*. There is a need for youths to be given special

attention and priority for seminars, study visits and workshops because these are the ones expected to perpetuate the *Striga* war when elders are retired.

(d) Rhizotrons and pot experiments should not be used for farmers training as they perpetuate the school like protocol (top down delivery of knowledge which discourage learning). The project is needed to scale up a mechanism through which a combination of learning tools will be used in sending messages to farmers. Also a project should consider using community theatres as a learning approach in future.

(e) Working papers should be produced in English and Kiswahili for use by farmers so that they could also be able to discuss and/or comment on the progress of on going activities. This is very important because farmers as key players are supposed to be informed of the proceedings of what they are doing. The process will also enhance a sense of belonging to the farmers and hence full participation.

(f) There is need to start radio listening clubs for farmers (RFFs) such that agricultural information broadcasted through radio programme can be heard and discussed by farmers as a group. In this process a mechanism should be in place to ensure that questions and problem arising from the RFFs easily reach the programmers and the answers are relayed back (efficient feedback mechanism).

Also there should be arrangements to ensure that farmers in these RFFs get affordable radios and batteries to assure them access to radio programmes.

There is a need to start information centres in villages, which will be under the supervision of the VEW, where research outcomes and learning materials will be placed and become accessible to all farmers and other stakeholders.

(g) Posters and leaflets should be produced with logos indicative of donors and/or implementing agent(s) to make them authoritative. They should also include names, addresses and e-mails (if any) of contact persons, not only the names and addresses of departments and organisations concerned. Posters and leaflets should also be produced with only one specific subject matter, that is, *Striga* to avoid confusion of the targeted readers and not more than one subject matter for example *Striga* and smut.

The posters should be transformed into leaflets such that each illustration and/or picture is put on its own page and satisfactory explanation included. Deliberate efforts need to be made to, produce learning tools for use by farmers as a group different from those of other stakeholders. These are required to have texts with large fonts, elaborate pictures and illustrations that have large size.

Adequate copies of printed materials (posters, leaflets, manuals and working papers) should be produced to reach as many stakeholders as possible. The placement of posters should be in the proposed information centres (recommendation 'f') to ensure accessibility to all stakeholders.

5.5 Suggestion for further research.

The study was conducted on areas where farmers are aware of the *Striga* project, the same study could be carried in places where the project has never operated and then compare the results for consistency. Special emphasis should be given to the development of learning materials for use by different stakeholders.

REFERENCES

Axinn, G.H (1988). *Guide on Alternative Extension Approaches*. Rome. FAO. 299pp.

Bakari, J.A. (1996) Community theatre as an appropriate methodology for development. In: *Engaging participation: the use of video as a tool in Rural Development Workshop Proceedings. (Edited by Jessey, K)*. Bagamoyo Tanzania 27 – 31 May, 1996. Farmesa/FAO. pp. 72-90.

Baltissen, G., E. Wambwile, M. Kooijman and T. Defoer (2000). *Facilitating learning processes in Agricultural extension: Lessons from Western Kenya*, KARI-KIT. pp. 1-5.

Barker, D (1980). Appropriate methodology: Using a traditional African board game in measuring farmers' attitude and environmental images. In: *Indigenous Knowledge Systems and Development, (Edited by Brokensha, D., Warren D.M. and Warner, O.)*. New York: University Press. pp. 297-302.

Basant, R. (1988). The Diffusion of agro-mechanical technology for Indian rainfed farming: An exploratory analysis *Agricultural Administration (Research and extension) Network Discussion Paper* No. 24. ODI: London. pp. 119-130

Braun, R. A; Thiele, G and Fernandez, M. (2000). Farmer Field Schools and Local Agricultural Committee: Complementary platform for integrated decision-making in sustainable agriculture. *Agricultural Research and Extension Network (AgREN) paper Number* 105. Overseas Development Institute, London. pp 200-215

Byaruhanga, J. (2001) How community cadres become model farmers. *Ground up* 1:5 pp. 15-16.

Capital Development Authority (1976)."National Capital Master Plan, Dodoma, Tanzania" Technical Supplement No.1-7, Project Planning Associates Limited, Toronto, Canada. pp. 16-25.

Chagaka, Y.A (1998). Factors influencing women participation in community development projects: the case study of child survival, protection and development. Unpublished Dissertation for Award of MSc degree at Sokoine University of Agriculture, Morogoro, Tanzania, pp. 72-88

Cooksey, B and Lokuji, A (1995). *Some Practical Research Guidelines.* Research on Poverty Alleviation (REPOA), Dar es salaam. 53 pp.

Conway, G.R. (1987). The properties of agro-ecosystems. *Agricultural Systems.* 24: 95–117.

Debra, S.K. (1994). Socio-economic constraints to the adoption of weed control technologies: The case of *Striga* control in West African Semi Arid Tropics. *International Journal of Pest Management* 40: 153-158.

Dogget, H (1965). *Striga hermonthica* on Sorgum in East Africa. *Journal of Agriculture Science* 65: 183-194.

Engel, P.G.H. (1997) *The Social Organisation of Innovation. A focus on stakeholders intervention.* KIT-CTA-STOAS. 45 pp

Esilaba, A. O; Mulatu, T; Reda, F; Ransom, J. K; Woldewahid, G; Tesfaye, A; Fitwy,I and Abaye, G (1997).Factors affecting the incidence of *Striga* and its control in northern Ethiopia. In: *Proceedings of the 16th Biennual Weed Science Society Conference For Eastern Africa.* (Edited by Adipala, E.; Tusiime, G.; Okori, P). Kampala 15-18 September 1997, Uganda pp. 221-229.

FAO, (1995). *Ecology and Rural Education: Manual for Rural Teachers.* FAO, Rome. 25 pp.

Feuerstein, M.T. (1986). *Partners in Evaluation.* Macmillan Education Ltd. London. 196pp.

Goon, A.M; Gupta, M.K and Dasgupta, B (2001). *Fundamentals of Statistics-II.* 7th Edition. World Press.Culcutta. 175pp.

Heong, K.L. and Escalada, M.M (1999). Quantifying rice farmers' pest management decisions: beliefs and subjective norms in stem borer control. *Crop Protection* 18: 315-322.

Inades-Formation Tanzania (IFTz) (2000) *Annual Report 2000.*Dodoma, Tanzania. 150pp.

Juma, C. (1987). Ecological complexity and Agricultural Innovation: the use of the indigenous genetic resources in Bungoma, Kenya, IDS Workshop. pp 13-19.

Kajembe, G.C. (1994). Indigenous Management System as a basis for community Forest in Tanzania. A case study of Dodoma urban and Lushoto Districts. *Tropical Resource Management Paper Number 6.* Wageningen University, The Netherlands. 194 pp.

Kakunta, C (2001). Zambia stays tuned to farm radio. *Ground up* 1(5): 20-21.

Kamara, B.A. (1993). The role of indigenous knowledge in Biological Diversity Conservation: Local and global dimensions. In: *Proceedings of the International Workshop on Interest and global imperatives.* ACTS Press, Nairobi. 59 pp.

Kanampiu, F.K, J.K Ransom and J. Gressel (1997). Advantage of seed primed inazapyr for *Striga hermonthica* control on maize bearing target site resistance. In: *Proceedings of the 16th Biennial Weed Science Society Conference For Eastern Africa.* (Edited by Adipala, E; Tusiime, G; Okori, P). Kampala 15-18 September 1997, Uganda pp 241-246.

Kaswende J,D.S.M, Hella, J. P, Mbwaga, A.M and Massawe, E.R (2000).On farm verification of maize cowpea intercropping for control of *Striga asiatica* (L) (witch weed). In: *Proceedings of the first University – wide Scientific Conference.* (Edited by Matovelo,J.A, Luzi-Kihupi.A, Monesta and Mgasa, M. N). Morogoro 5th –7th 2000 –NORAD. pp 327-335.

Kauzeni, A.S. (1989) *Effective Agricultural Extension Service: The Tanzania Experience.* Swala Publications. Dar es Salaam. 73 pp.

Kimakwa, S (2001). The problem with training-and-visit (T&V). *Ground up* 1(5): 10-11.

Knight, C.G. (1980) Ethnoscience and the African farmer: Rationale and Strategy. In *Indigenous Knowledge systems and Development.* (Edited by Brokensha, D., Waren D.M. and Warner, O.). Lanham New York University Press. pp. 203-231.

Lamboll, R. (2000) *Striga* Research activities in Dodoma region: Evaluation of On-farm research Trials 1999/2000 season. Ilonga ARI Tanzania, Natural Resource Institute, University of Greenwich, UK and University of Sheffield, UK. 44pp.

Lamboll, R., Hella, J., Riches, C., Mbwaga, A., and G. Ley (2001) Integrated Management of *Striga* Species on Cereal Crops in Tanzania: Preliminary Study of Farmer Perceptions of Soil Resources in Central, Lake and Eastern Zones. Ilonga ARI, Natural Resources Institute, University Of Greenwich, U.K., University of Sheffield, U.K. and Sokoine University of Agriculture, Tanzania.pp 59-64

Lamboll, R.I., Gowen, S.R., Ssenywanga, J.K., Asaba, J.F., Bagamba, F., Robinson, E., Ruherford, M.A., Tushemereirwe, W.K. and Arinaitwe, M. (2000). Factors affecting the uptake and adoption of outputs of crop protection research in banana-based cropping sytems in Uganda. *In: Sustaining Change: Proceedings of a Workshop on the Factors Affecting Uptake and Adoption of Department For International Development (DFID) Crop Protection Programme (CPP) Research Outputs.* (Edited by Hainsworth, S.D. and Eden-Green, S.J.). Imperial College at Wye, Kent, UK 21-23 June 2000. Natural Resource International Limited, Chatham Maritime, Kent, UK. pp. 49-64.

Lazaro, E.A., Maeda-Machangu, A., Laswai, G., Kimambo, E., Mutayoba, S., and Mwaseba, D. (2000). Local Knowledge: A resource in the improvement of

livestock production systems in Tanzania. *In Proceedings of the first University-wide Scientific Conference.* (Edited by Matovelo, J.A., Luzi-Kihupi, A. Monela, .C., and Mgasa). Morogoro. 5th – 7th April 2000. Volume 2. SUA – NORAD. pp 99-104.

Lugeye, S. (1994). The role of farmers' indigenous knowledge in natural resources management. *In Proceedings of the Sokoine University of Agriculture Convocation, 1st Workshop* (Edited by N. Hatibu, S. Madoffe, A.E. Pereka, S.T. Mafu, R.S. Machang'u and D.F. Rutatora). July, 26th – 27th 1994. Morogoro. Tanzania:pp 116-125.

MAC (1999) The National Agricultural Extension Project Phase II (NAEP II). Mid Term Review. Ministry of Agriculture and Cooperatives. Dar es Salaam. 95 pp.

Mafuru, J.M (1999). The extent and farmer perceptions of *Striga* in the Lake Zone, Tanzania. In: *Striga distribution and management in Tanzania proceedings of stakeholder workshop.* Ilonga ARI, Tanzania, NRI University of Greenwich, UK and University of Sheffield, UK. 8-9 September 1999. Dar-es-salaam, Tanzania. pp. 23-28.

Mbwaga, A.M. (1994). *Striga* and *Allectra* survey on occurrence, distribution and on farm verification of *Striga* control practices for small-scale farmers in Tanzania. PPIP-SIDA and MOA. 35 pp

Mbwaga, A.M. (1996). Status of *Striga* species in Tanzania: occurrence, distribution and on-farm control packages. In: *Drought tolerant crops for Southern Africa*. Proceedings of the SADC/ICRISAT Regional Sorghum and Pearl millet Workshop, 25-29 July 1996. Gaborone, Botswana. pp 195-200.

Mbwaga, A.M. (1999). Strategies for *Striga* research in Tanzania. Ilonga ARI. Ministry of Agriculture and Food Security.Tanzania. 20 pp

Mbwaga, A.M. and Obilana, A.T. (1993). Parasitic weeds in cereals in Tanzania: The specificity of *Striga, Allectra* and *S. hemonthica* to cereals. *International Journal of Pest Management*. 11(1): 239-260.

Mbwaga, A.M; Kaswende,J and Shayo,E (2000). A Reference manual on Striga Distribution and Control in Tanzania. SIDA/FAO-FARMESA Ilonga ARI. 26pp.

Meir, C.J (1999). Improving women's participation in pest management training: a pilot study in Honduras. In: *Women and IPM: crop protection practices and strategies*. (Edited by van de Fliert, E and Proost, J). Royal Tropical Institute

(KIT) Amsterdam, The Netherlands/ Intermediate Technology Publications. London, UK. 85 pp

Millar, D (1992). *Footprints in the mud.* Wageningen University. 62. pp

Millar, D (2001). Using the footpath analogy. *Compass magazine.* pp 40-42.

Moock, J and Rhoades, R (1992). *Diversity of Farmer Knowledge and Sustainability.* Cornell University Press. Ithaca, New York. 215pp.

Moore, C. (1980). New shoots from old roots. In *indigenous Knowledge Systems and Development.* (Edited by Brokensha, D., Waren, D.M., Werner, O). Lanham New York University Press. pp. 378-392.

Moris, J. (1991) *Extension Alternatives in Tropical Africa.* Overseas Development Institute (ODI). Regent's College, London. 184 pp.

Moser, C.A and Kalton, G.C (1973). *Survey Methods in Social Investigation.* Second edition.Heinemann.121 pp.

Mtama, L.Y. (1997). Factors influencing female-headed household involvement in Sasakawa Global 2000 project in Rukwa Region. Unpublished Dissertation for Award of MSc degree at Sokoine University of Agriculture, Morogoro, Tanzania, pp. 50-84.

Mumford, J.D and Norton, G.A (1984). Economics of decicion making in pest management. *Annual Review of Entomology* 29: 157-174.

Nombo, C and Mattee, A.Z. (1998). Factors, which motivate farmers to join and participate in groups: The case of Mgeta and Mkuyuni Divisions, Morogoro Rural district, Tanzania. *Journal of Agricultural Economics and Development* 2:47-54.

NORAD (1997). *The Logical Framework Approach.* Handbook for Objectives – Oriented Planning. NORAD, Oslo. 124pp.

Nyamungumi, P and Mika, J.D. (2001). Report on services provided through Radio Tanzania Dar es salaam Central zone farm programme and other communication/information channels. URT – Information Services – central zone. pp 20-28

Ooi, P.A.C. (1996) Experiences in educating rice farmers to understand biological control. *Entomophaga* 41: 375-385.

Otieno–Oruko, L., Asaba, J.F., Kindness, H.M. (2000) Factors affecting uptake and adoption of outputs of crop protection research in peri-urban vegetable systems in Kenya. In: *Sustaining Change: Proceedings of Workshop on The Factors Affecting Uptake and Adoption of Department For International*

Development (DFID) Crop Protection Programme (CPP) Research Output. (Edited by Hainsworth, S.D. and Eden-Green, S.J.). Imperial College at Wye, Kent, UK. 21-23 June 2000. Natural Resources International Limited, Chatham Maritime, Kent UK. pp 27-34

Ramaiah, K.V; C.Parker; M.J. Vasudeva Rao and L.J. Musselman(1983). *Striga Identification and Control handbook, Information Bulletin* N° 15 A.P, India-ICRISAT. pp 22-45.

Riches, C.R (1999). Sorghum and Millet *Striga* research in UK: Contributions to International Programs. In: *Report on sector review for Striga control in sorghum and millet.* (Edited by Hess, D.E. and Lenne, J.M) ICRISAT-Bamako, 27-28 May1999. Bamako, Mali. pp 75-81.

Rist, S. (1993). Supporting indigenous knowledge for sustainable rural development in Bolivia: The case of AGRUCO. *In Linking with farmers: networking low-external – input and sustainable agriculture.* (Edited by Alders, C., Haverkort, B and van Veldhuizen, L). London. Intermediate Technology Publication. pp. 93–107.

Sauerborn, J. (1991). *Parasitic hovering plants: Ecology and management.* Verlag Joseph Margraf Scientific Books. 355pp.

Schucherdt, J and Cunningham. C.J. (1987) Extensions Crossroads in Turbulent times. Downsizing or downgrading. *Journal of Extension*. XXV. 4-6.

Schwatz L.A. and Kampen J. (1992) *Agricultural Extension in East Africa.* World Bank Technical Paper No 164. 59 pp.

Scoones, I and Thompson, J. (1994). Knowledge, power and agriculture – towards a theoretical understanding. *In Beyond Farmer first: Rural people's knowledge, agriculture research and extension practice.* (Edited by Scoones, Thompson and J.S, I). International Institute for Environment and Development (IIED). London. Intermediate Technology Publications Ltd (IT). pp 16 – 32

Stewart, D.W. and Shamdasani, N.P. (1990). *Focus groups: Theory and Practice. Applied Social Science Research Methods Series* vol.20. Sage publications. New Delhi. 408pp.

Supe, S.V(1997). *An Introduction to extension 2nd Edition.* Oxford and IBH Publishing Co PVT Ltd. New Delhi. 300pp.

TARP II – SUA Project (2001) Learning through inter-zonal farmer exchange visits in the eastern and southern highland zones. Sokoine University of Agriculture. 3pp.

United Republic of Tanzania (1997). *Dodoma Region Socio-economic Profile*. The Planning Commission, Dar-es-salaam and Regional Commissioner's Office, Dodoma. 104 pp.

United Republic of Tanzania (1994). *Household budget survey 1990/91*. Bureau of Statistics, Planning Commission, Dar-es-salaam. 180 pp.

Urio, A.H. (1996). A comparative study of two agricultural extension approaches in Dodoma Region, Tanzania. Unpublished Dissertation for Award of MSc degree at Sokoine University of Agriculture, Morogoro, Tanzania, pp.63-75

Warner, K (1991). Shifting Agriculture: Local technical knowledge and natural resources management in the humid tropics. *Community forestry Note No. 8.* FAO, Rome. pp 59-63

Weihrich, H. and Koontz, H. (1993). *Management. A Global Perspective.* McGraw Hill, New York. 744 pp.

Wole, D (1995). The learning process. In: *Teach your Best: A handbook for University Lecturers*, (Edited by Matiru, B; Mwangi A and Schlette, R). ISOS/DSE/IKO. Bonn pp 114-118.

APPENDICES

Appendix 1: Guiding questions for Focus Group Discussions (FGDs)

Knowledge and information

1) Do know this weed? (Show a picture or a live plant of *Striga)*
2) What is the name this plant in local language?
3) What is this local name mean or imply?
4) Can you tell the crops affected by this plant?
5) In which soil types do this plants prevail? Why do you think so?
6) What are your perceptions of *Striga*?
7) Do you think this plant affected only a certain group of people in the society i.e. poorer people?
8) How did you control it traditionally?
9) How do you control it at present?
10) Do these ways you use in controlling *Striga* are useful?
11) What do you see is *Striga* increasing or decreasing as years go by?
12) Where did you hear about FRG?
13) What have you learnt in FRG?
14) What things attributed you to join in FRG?
15) How do you see your agricultural performance as you compare the time after and before joining in FRG?

Training needs

16) Is there anything you need know more about *Striga*?
17) Is there anything you need to know about *Striga* management?

Learning tools evaluation

18) How do you assess these learning tools (posters, leaflets and manual)? In terms of the following criteria:

- Content/message consistence
- Language used
- Time taken to understand the message
- Ease of understanding

- Ease of use (is the presence of a moderator necessary)
- Availability of the materials
- Places where materials are available

19) Community theatre (drama and songs) as a learning tool

- Have you ever attended or heard of community theatres?
- Where do you hear or attend these community theatres?
- What was the theme of these community theatres you attended/heard?
- Do you hear anything about *Striga* in theatres?

Appendix 2: Guiding questions for In-depth interviews

Knowledge and information

1) Do know this weed? (Show a picture or a live plant of *Striga)*
2) What is the name this plant in local language?
3) What is this local name mean or imply?
4) Can you tell the crops affected by this plant?
5) In which soil types do this plants prevail? Why do you think so?
6) What are your perceptions of *Striga*?
7) Do you think this plant affected only a certain group of people in the society i.e. poorer people?
8) How did you control it traditionally?
9) How do you control it at present?
10) Do these ways you use in controlling *Striga* are useful?
11) What do you see is *Striga* increasing or decreasing as years go by?
12) Where did you hear about FRG?
13) What have you learnt in FRG?
14) What things attributed you to join in FRG?
15) How do you see your agricultural performance as you compare the time after and before joining in FRG?
16) Sources of information:

- Draw the plan of your field on soil then indicate what you are practising?
- Why do you practice that?
- And from whom do you learn the practice? (Few farmers were asked).
- Then pair wise ranking of the information sources was performed by a group of farmers.

Training needs

17) Is there anything you need know more about *Striga*?
18) Is there anything you need to know about *Striga* management?

Learning tools evaluation

19) How do you assess these learning tools (posters, leaflets and manual)? In terms of the following criteria:

- Content/message consistence
- Language used
- Time taken to understand the message
- Ease of understanding
- Ease of use (is the presence of a moderator necessary)
- Availability of the materials
- Places where materials are available

20) Radio as a learning tool

- Do you own a radio?
- Have you ever heard of any agricultural program through radio?
- Have you ever heard anything on *Striga*?
- At what time of the day the agricultural programs are broadcasted?
- At what time do you listen to radio programs?

21) *Striga* trials as learning tools

- Do other farmers come to learn on your trials?
- How many farmers have visited your trials?
- Where are these farmers come from?
- Do they try/learn anything from your trials?

22) Community theatre (drama and songs) as a learning tool

- Have you ever attended or heard of community theatres?
- Where do you hear or attend these community theatres?
- What was the theme of these community theatres you attended/heard?
- Do you hear anything about *Striga* in theatres?

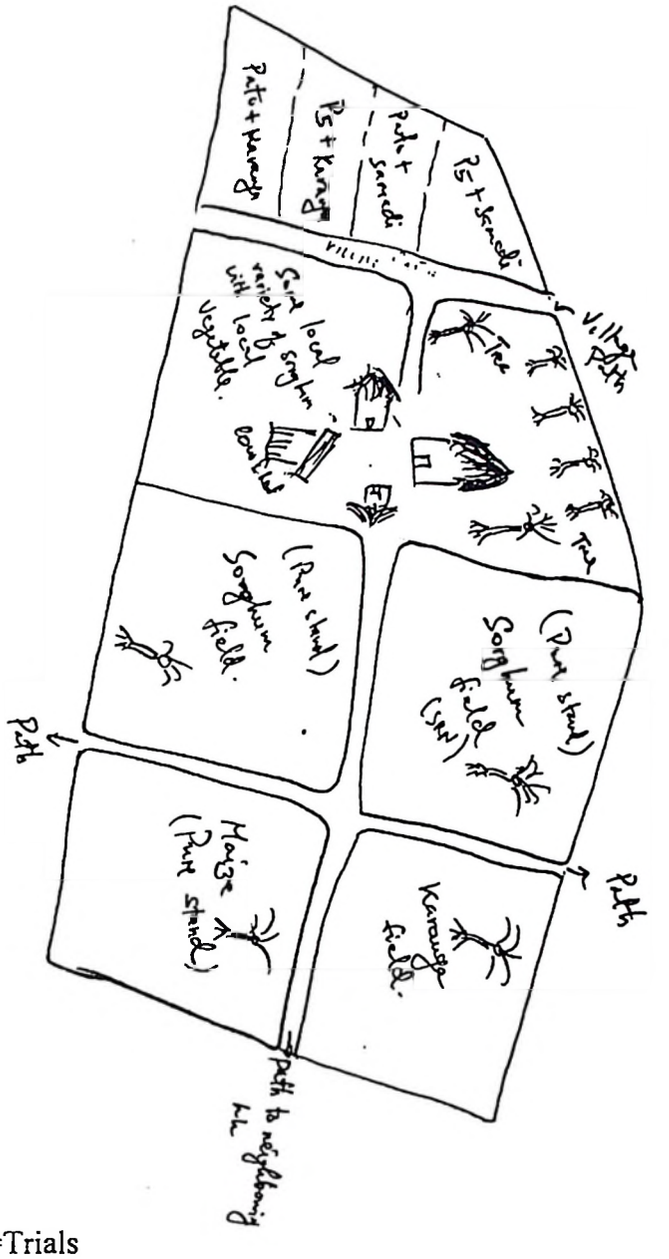
Appendix 3: A checklist for key informants (Scientists, NGOs, Extension staff, School children and University students).

- Perception of importance of *Striga* knowledge
- Sources of knowledge
- Access to sources of knowledge
- Knowledge of *Striga* biology
- Knowledge of *Striga* management
- Training needs
- Evaluation of tools
- Perception of farmers' knowledge of *Striga*

Appendix 4: A Summary of Learning Tools and Approaches

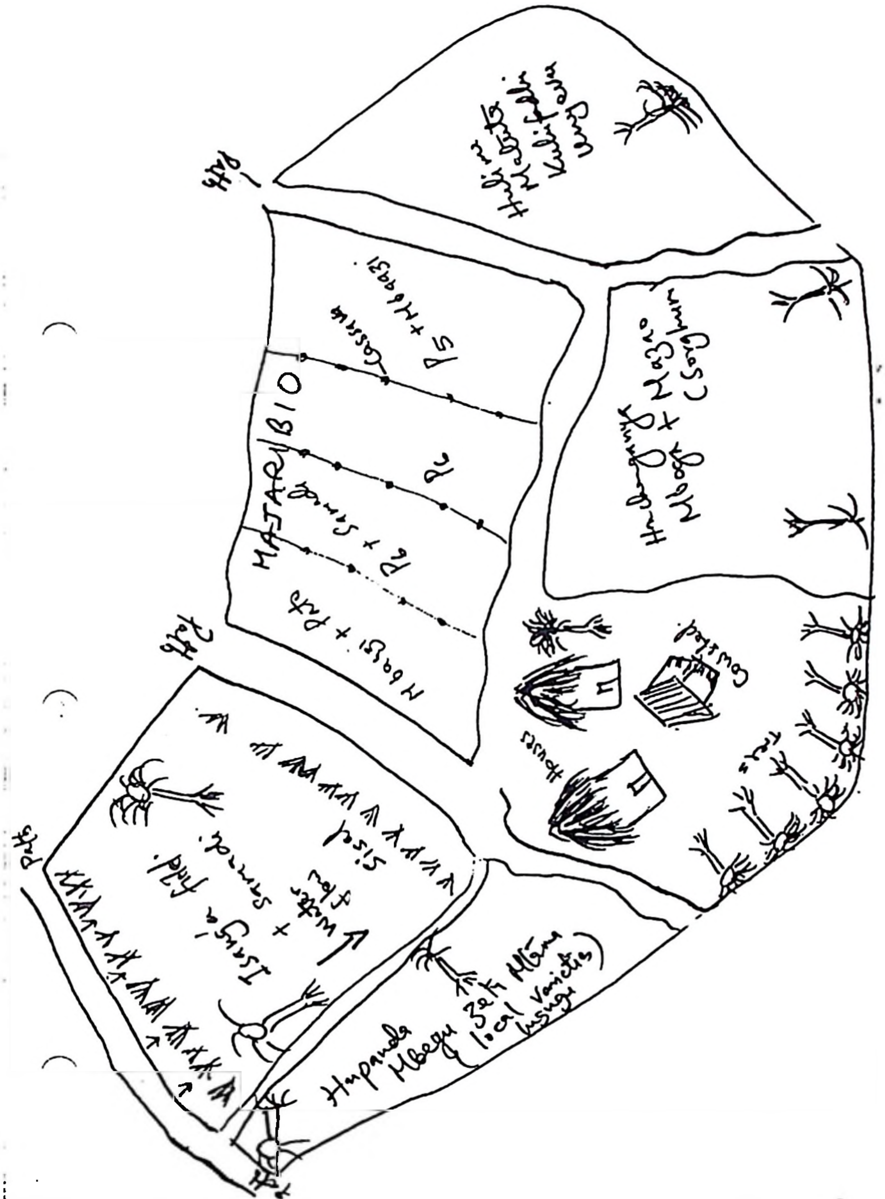
Learning approaches	Learning Tools	Target groups
FFS	-Demo plots -Posters -Drawings	-Farmers -Extensionists -Reseachers
PLAR	-Posters -Interviews -Field reports/ working papers -Demo plots	-Farmers -Extensionists -Reseachers
PARM	-Posters -Interviews -Field reports	-Farmers -Extensionists -Reseachers -NGOs
ELA	-Demo plots -Posters -Field reports	-Farmers -Extensionists -Reseachers
BAFOD	-Demo plots	-Farmers -Extensionists -Reseachers
RFFs	-Radio	-Farmers -Extensionists
CAAs	-Manuals -Leaflets -Posters -Demo plots	-Farmers -Extensionists
T&V	-Manuals -Leaflets -Posters	-Farmers -Extensionists -Reseachers
FEVs	Demo plots Interviews	-Farmers -Extensionists -Reseachers
Community theatres	Posters Drama Songs Real objects	-Farmers -Extensionists -Reseachers

Appendix 5 A typical sketch of farmers' field in Mvumi Makulu.



Key: Majaribio=Trials
Macia= sorghum variety
Boma = kraal
Karanga= groudnut
Njugu = bambara nuts
Samadi= cow dung

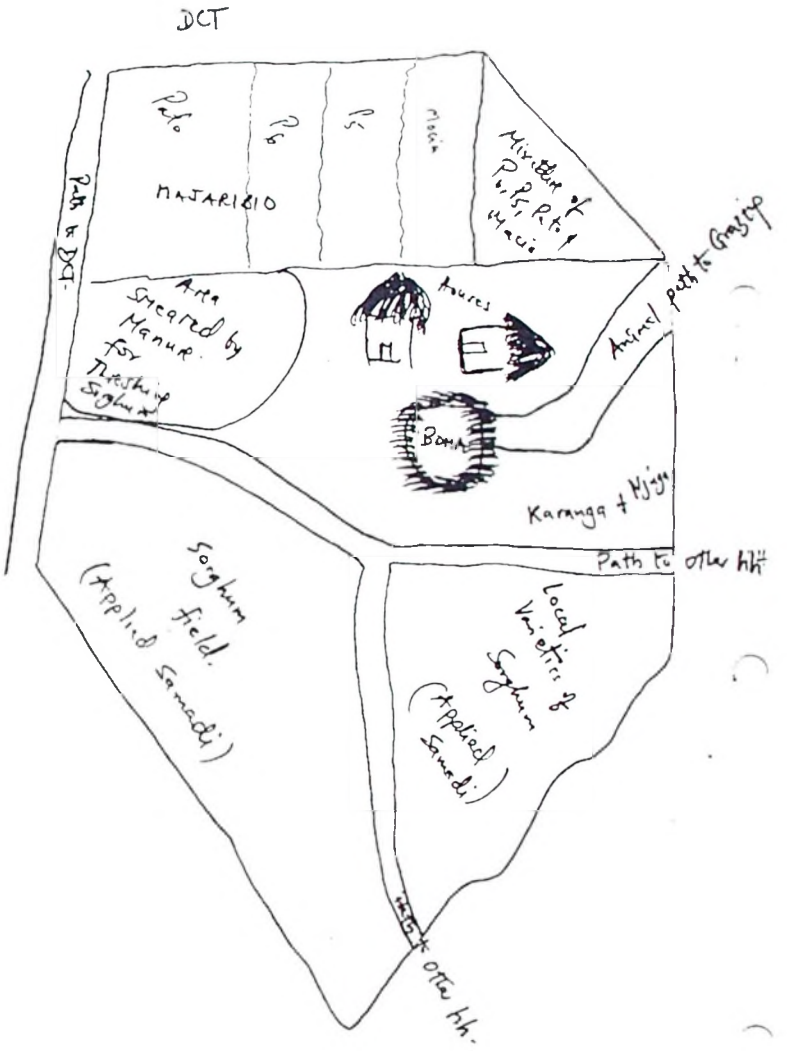
Appendix 6 A typical sketch of farmers' field in Mvumi Makulu.



Key: Mbaazi = pigeon peas
Pato = improved variety of sorghum
Isang'a = sand soil
Matuta = ridges
Kuhifadhi = to conserve
Majaribio= trials

Unyevu=moisture
Mazao=crop
Mboga= vegetable
samadi=cow dung
mtama= sorghum

Appendix 7 A typical sketch of farmers' field in Chipanga 'A'.



Key: Samadi = cow dung
Mbaazi = pigeon pea
Mboga = vegetable
Mazao = crops
Majaribio = trials
Mtama = sorghum
Matuta= ridges

Unyevu= moisture
Kuhifadhi= to conserve
Kupanda= to sow
Lugugu= local variety of sorghum
Mbegu = seeds

Appendix 9: Pairwise Ranking of Sources of Information-Chipanga 'A'

	PARENTS	NEIGHBOURING FARMERS	OWN INITIATIVES	EXTENSION	RESEARCH	FARMER EXCHANGE VISITS/DISTANT FARMERS	NGO
PARENTS	X	PARENTS	OWN INITIATIVES	EXTENSION	RESEARCH	FEV	PARENTS
NEIGHBOURING FARMERS	X	X	OWN INITIATIVES	EXTENSION	RESEARCH	FEV	NGO
OWN INITIATIVES	X	X	X	EXTENSION	OWN INITIATIVES	FEV/DISTANT FARMERS	OWN INITIATIVES
EXTENSION	X	X	X	X	EXTENSION	FEV	EXTENSION
RESEARCH	X	X	X	X	X	FEV	NGO
FARMER EXCHANGE VISITS/DISTANT FARMERS	X	X	X	X	X	X	FEV/DISTANT FARMERS
NGO	X	X	X	X	X	X	X
TOTAL SCORE	2	0	4	5	2	6	2
RANKING	4	5	3	2	4	1	4

A group of 9 farmers (5 Men and 4 women).

Appendix 8: Pairwise Ranking of Sources of Information-Mvumi Makulu

	PARENTS	NEIGHBOURING FARMERS	OWN INITIATIVES	EXTENSION	RESEARCH	FARMER EXCHANGE VISITS/DISTANT FARMERS	NGO
PARENTS	X	PARENTS	PARENTS	PARENTS	PARENTS	PARENTS	NGO
NEIGHBOURING FARMERS	X	X	N.FARMERS	EXTENSION	RESEARCH	N.FARMERS	NGO
OWN INITIATIVES	X	X	X	EXTENSION	RESEARCH	FEV/DISTANT FARMERS	NGO
EXTENSION	X	X	X	X	RESEARCH	EXTENSION	EXTENSION
RESEARCH	X	X	X	X	X	RESEARCH	NGO
FARMER EXCHANGE VISITS/DISTANT FARMERS	X	X	X	X	X	X	FEV/DISTANT FARMERS
NGO	X	X	X	X	X	X	X
TOTAL SCORE	5	2	0	4	4	2	4
RANKING	1	3	4	2	2	3	2

A group of 12 farmers (7 Men and 5 women).