Paper F

Assessment of Farmers' Knowledge and Perception of *Striga*: The case of Mvumi Makulu and Chipanga 'A' villages in Dodoma District, Tanzania.

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Abstract
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. It is speculated that 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. This paper attempts to evaluate farmers' and other stakeholders' knowledge of Striga biology and management. It also assesses the usefulness of knowledge and factors influencing the application of knowledge as well as assessing of learning tools for improving farmers' and other stakeholders' understanding of Striga biology. The learning tools will aid in imparting knowledge of biological concepts to farmers and other stakeholders so that they can combat the witchweed and improve cereal productivity as well as their livelihoods. It has been learnt that farmers have known Striga before independence and urged to use a combination of learning tools so as to transfer knowledge, as no one tool has been proved to be superior to others. Also there is need to start information centres in villages to ensure that learning materials are readily available to farmers.

1.0 Introduction

*Strig*a *specie*s 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, to 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).

Striga research and control in Tanzania has a long history. It was conducted in 1950s in Lake Victoria Basin (Mbwaga *et al.*, 2000), and was 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. The United Kingdom's Department For International Development-Crop Protection Programme and Government of Tanzania fund this project. Under the project 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. knowledge of the biology of *Striga*, which is considered to be key in its control has not yet been adequatey disseminated. 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).

This study is specifically attempted to evaluate farmers' and other stakeholders' knowledge of Striga biology and management. Also it assessed the usefulness of knowledge acquired and factors influencing the application of this knowledge. Furthermore the study assessed the learning tools for improving farmers' and other stakeholders' understanding of *Striga* biology. The learning tools will aid in imparting knowledge of biological concepts to farmers and other stakeholders so that they can combat the witchweed and improve cereal productivity as well as their livelihoods.

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.

Many tools and approaches have been developed to meet this purpose. These tools and approaches include printed materials such as leaflets, posters, working papers and manuals. Others are radio programmes, community theatres (drama and songs) and *Striga* trials.

2.0 Methodology

2.1 Study Location and Justification for its Selection

The 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^{o} and $7^{o}30^{'}$ south and between longitude 35^{o} and 37^{o} east. The Region covers some 41,372 square kilometres or five percent of the total land area of Tanzania Mainland (URT, 1994).

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^{o}C and 35^{o}C. The major activities are agriculture and livestock keeping. The crops grown correlate well with both the rainfall pattern and 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 in this area 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 deemed convenient.

2.2 Research Design

This research adopted a cross-sectional study in which a triple phase survey involving Focus Group Discussions, in-depth and key informant interviews were 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 was the case of this study.

2.3 Sampling Design

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 Sokoine University of Agriculture undergraduate students of degree programme that took a course on weed management. These are 3rd year Bachelor of Science (B.Sc.) (Agronomy), 3rd year B.Sc. (Horticulture) and 4th year B.Sc. (Agriculture General). Researchers from Ilonga ARI, trainers from INADES-Formation Tanzania, extension staffs at village and district level were also included in 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 in 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 (community theatres and printed materials consisting of posters, leaflets, working papers and a manual) were evaluated. The learning tools were chosen for the reason stated previously (section 1.0). 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 INADES-Formation Tanzania who were involved in the key informant interviews during the third phase. 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 in weed management.

2.4 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, 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.

Then a series of focus group discussions were carried out later, where knowledge and learning tools were evaluated. The researcher who also was taking notes during the FGDs proceedings facilitated the FGDs. 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.

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.

Some farmers were gathered in-groups comprised of males and females to perform pairwise ranking of sources of information. The same guide applied on FGD was used with an addition of aspect concerning radio and *Striga* trial plots. The data collection was concluded with the key informants' interviews. 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).

3.5 Data Analysis

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

Pair wise ranking was used to rank the sources of information. 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.

2.0 Results and discussion

3.1 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. Mbwaga *et al*. (2000) had also similar observations. 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 by different tribes, which are associated with its damage to the crops and nature of the attack, which is considered mysterious

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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 revealed 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 has led to farmers not adopting the new innovation.

3.2 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.

Farmers in Chipanga 'A' ranked the sources differently from 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 experimenting. 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. Farmers in the two villages ranked the sources differently due to the differences in perception of the criteria used on ranking exercise.

3.3 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.

3.4 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.

(i) 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.

(ii) 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 authors argue strongly that, farmers can not ignore these factors as important attributes influencing the adoption and use of knowledge.

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	Maximise 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 penalised if allowing them astray	HADO

Source: Dodoma survey, 2002

(iii) 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 food shortages, 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 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.

3.5 Evaluation of learning tools

Various learning tools were identified and taken to farmers for evaluation. These tools include the rhizotron, pot experiments, posters, leaflets and radio. Others were community theaters (Drama and groups) and *Striga* trials. Farmers in both Mvumi Makulu and Chipanga "A" were awarding scores between zero and five basing on their perceptions as less interactive tool for zero mark and very interactive tool for five mark. The farmers included those who participated in Farmer Researcher Groups (FRGs) on *Striga* control project and those who were not. The perception for each tool will be presented by village, and by groups i.e. Farmer Researcher Groups versus non-Farmer Researcher Groups and by sex for those who were in Farmer Researcher Group.

3.5.1 Farmers' perceptions on learning tools effectiveness at Mvumi Makulu

Thirteen farmers were involved in the process. The group comprised of six men and four women (FRG members) as well as three men who were not FRG members. Women farmer researchers (FRG) rewarded five marks for the rhizotron, Radio and *Striga* trials. Then pot experiment and posters got four marks each followed by leaflets, which scored three, drama and songs got one mark.

Women farmer researchers gave the rhizotron five marks on the basis that they would be able to see what is really happening underground and how the *Striga* weed is attaching on the roots (that is to say the rhizotron is effective in showing the biology of *Striga* to farmers). The radio was given five marks as it helps those who could not read but they can hear, what is said also a larger mass of people could be reached although, this approach has its deficiencies that most of the farmers do not have radios and once the programme is announced it is not going to be repeated that day.

Striga trials were awarded five marks since farmers were responsible for their preparation and have set everything; they saw the results and had been helpful as they were provided free seeds. Further they had been able to produce two new seed variety of sorghum (*wahi* and *hakika*). Pot experiments and posters were given four marks in a sense that the pots reflect the situation on farmers field and they don't show what is happening underground this perpetuate the perception that *Striga* is witching their crops. The posters were marked four because it has good pictures which show the biology of *Striga* but most farmers could not read, they are attracted by pictures which mostly show the experience they had been exposed on the seminars.

Community theatres (drama and songs) were awarded one mark because these are rarely happen in these areas (Mvumi Makulu) and most of the time it is costing to prepare them. Hence, women FRGs ranked *Striga* trials, radio and rhizotrons the first tool to use in learning followed by pot experiments and posters, then drama and songs, lastly came the leaflets.

Table 2: Perception of women (FRG) on the effectiveness of the learning tools

Tools	0	1	2	3	4	5	Mark	Rank
Rhizotron						√	5	1
Pot experiments					√		4	4
Posters					√		4	4
Leaflets				√			3	7
Radio						√	5	1
Drama & songs		√					1	6
Striga trials						√	5	1

Men FRGs perceptions on effectiveness of the learning tools.

Men in Mvumi Makulu, had awarded the rhizotrons and Striga trials similarly to women but a slight difference appear on pot experiment which got five in men's group. The leaflets scored four, followed by posters three then the radio two and last drama and songs one.

Reasons for this outcome are as follows, men argued that they prepared the rhizotron and pot experiments and they saw the results, this mean that these two complement each other. The pots show the real situation as it is in the farmers' field while the rhizotrons displayed the situation underground. *Striga* trials is given five points, as the farmers felt that they owned the trials and were fully involved in the preparation and evaluation of the trials *"it is actually effective in learning compared to the other two"* one farmer commented. Leaflets scored four compared to posters because they are easy to handle and farmers could easily take them home and read when they get time while the posters could not be taken from where they are posted *"we read them and leave them at the polls or walls but the leaflet can be taken home*" the farmer commented. Radio is awarded two marks because few people have radios and most people prefer listening to other programme rather than agricultural programme. Community theatres were awarded one mark for the reason that they are performed rarely in the village.

Table 3: Men FRG members scores at Mvumi Makulu

Tools	0	1	2	3	4	5	Mark	Rank
Rhizotron						√	5	1
Pot experiments						√	5	1
Posters				√			3	5
Leaflets					√		4	4
Radio			√				2	6
Drama & songs		√					1	7
Striga trials						√	5	1

Actual ranking was that the rhizotron, pot experiments and *Striga* trials were ranked first tools to use in learning *Striga* biology, followed by leaflet, the posters were fifth and last were drama and songs.

Perception of non-FRG members on learning tools

Non-farmer researchers awarded five marks for the rhizotron, posters, community theatres and *Striga* trials. They also awarded four marks for pot experiments and leaflets and lastly the awarded two marks for Radio broadcast. Like other groups, the rhizotrons, and *Striga* trials were awarded five marks because the trials are too involving, farmers learn by doing (participation) while the rhizotron is showing clearly what is happening underground. The posters were awarded similarly to the rhizotron and trials because the picture shows daily experience of the farmers, and even if some of them could not read and write a moderator (fellow farmer, teacher or extension officer) could elaborate what is meant. The drama and songs (community theatres) although these are rarely performed out the messages are clearly and easily reach the larger population much further they are entertaining therefore most people get attracted to them.

Table 4: Non-FRG perception of learning tools at Mvumi Makulu

Tools	**0**	**1**	**2**	**3**	**4**	**5**	**Mark**	**Rank**
Rhizotron						√	5	1
Pot experiments					√		4	5
Posters						√	5	1
Leaflets					√		4	5
Radio			√				2	7
Drama & songs						√	5	1
Striga trials						√	5	1

Pots were awarded four because they are similar to what is in the farmers' fields, hence farmers could learn easier because it portrays their daily experiences. The leaflets were given four marks, as it is possible to carry them home and read them whenever farmers have time and easier to refer. Radio were given two marks since most of the farmers do not have radio and the programme usually are broadcast at around 5:30 pm in the evenings when most farmers are in the field and do not hear it. For those who prefer radio listening usually like the music programme, comedies etc. and not agricultural programme. Therefore the non-farmer researchers ranked, the rhizotron, poster, community theatres and *Striga* trials the first more effective learning tools for teaching farmers the *Striga* biology. Followed by leaflets and radio the last one.

Perception of men and women on the effectiveness of learning tools at Mvumi Makulu.

On combination of the total scores of men and women in Mvumi makulu, the Rhizotron and *Striga* trials appear to be the first effective learning tools followed by the pot experiment, then the posters with and the radio and drama the last one.

Table 5: Combined scores of FRG members at Mvumi Makulu

Tools	**WOMEN**	**MEN**	**TOTAL**	**RANK**
Rhizotron	5	5	10	1
Pot experiments	4	5	9	3
Posters	4	3	7	4
Leaflets	2	4	6	6
Radio	5	2	7	4
Drama & songs	3	1	4	7
Striga trials	5	5	10	1

Perception of FRG and non-FRG members of Mvumi Makulu on the effectiveness of learning tools.

The combination of scores for FRG and non-FRG members give the ranking as follows the Rhizotron and *Striga* trials were ranked first effective learning tools, followed by pot experiment (second), then the posters followed by leaflets fifth and last the radio and community theatres.

Table 6: Perception of FRG Vs Non-FRG Mvumi Makulu

Tools	**WOMEN (f)**	**MEN(f)**	**MEN (nf)**	**TOTAL**	**RANK**
Rhizotron	5	5	5	15	1
Pot experiments	4	5	4	13	3
Posters	4	3	5	12	4
Leaflets	2	4	4	10	5
Radio	5	2	2	9	6
Drama & songs	3	1	5	9	6
Striga trials	5	5	5	15	1

f= FRG members; nf= Non-FRG members

3.5.2 Farmers' perceptions on learning tools effectiveness at Chipanga 'A'

Eleven farmers were involved in the process. The group comprised of seven men and two women (FRG members) as well as two women who were not FRG members. The proceedings of evaluation exercise were as follows:

Perception of women (FRG) in Chipanga 'A' village on effectiveness of learning tools.

Women in Chipanga 'A' village had awarded five marks for the rhizotron and *Striga* trials. The four marks went to the pot experiments, leaflets and community theatres and three marks for both posters and radio broadcasts. Men similarly scored five marks the rhizotron and Striga trials. Four marks were awarded to pot experiments and three marks for the leaflets. Posters and community theatres got two marks each and radio broadcasts scored one mark.

Table 7: Perception of women FRG learning tools at Chipanga 'A' village

Tools	**0**	**1**	**2**	**3**	**4**	**5**	**Mark**	**Rank**
Rhizotron						√	5	2
Pot experiments					√		4	3
Posters				√			3	6
Leaflets					√		4	4
Radio				√			3	7
Drama & songs					√		4	5
Striga trials						√	5	1

Likewise the Non farmer researchers awarded the Rhizotrons and Striga trials five marks, four marks for pot experiments, three for leaflets and two for both posters and community theatres. One mark was awarded for radio broadcasts. Combinations of scores for men and women in Chipanga "A' village (FRG members).

Table 8: Perception of men FRG learning tools at Chipanga 'A' village

Tools	0	1	2	3	4	5	Mark	Rank
Rhizotron						√	5	2
Pot experiments					√		4	3
Posters			√				2	5
Leaflets				√			3	4
Radio		√					1	7
Drama & songs			√				2	6
Striga trials						√	5	1

Table 9: Perception of non-FRG learning tools at Chipanga 'A' village

Tools	0	1	2	3	4	5	Mark	Rank
Rhizotron						√	5	1
Pot experiments					√		4	3
Posters				√			3	4
Leaflets			√				2	5
Radio		√					1	7
Drama & songs			√				2	6
Striga trials						√	5	2

Both men and women scores were combined and results shows that *Striga* trials was the best learning approach for learning *Striga* biology i.e. it was the first, rhizotrons was the second pot experiment third, leaflets fourth, drama and songs were the fifth. Posters were sixth and radio broadcast were the seventh one.

Table 10: Combination of scores for men and women FRG members Chipanga 'A' village

Tools	WOMEN	MEN	TOTAL	RANK
Rhizotron	5	5	10	2
Pot experiments	4	4	8	3
Posters	3	2	5	6
Leaflets	4	3	7	4
Radio	3	1	4	7
Drama & songs	4	2	6	5
Striga trials	5	5	10	1

Combination of FRG members and Non FRG members in Chipanga ‘A’

The results of scores from the two groups yield the following. The Rhizotion and *Striga* trials were the first learning tools for teaching farmers *Striga* biology. Pot experiments followed, (third) and then fourth were posters and community theatres. Leaflets were fifth and radio broadcast was the sixth one. The reasons provided for the ranking were similar to that of Mvumi Makulu.

Table 11: Combination of FRG vs non-FRG Chipanga 'A' village

Tools	WOMEN (f)	MEN(f)	MEN (nf)	TOTAL	RANK
Rhizotron	5	5	5	15	1
Pot experiments	4	4	4	12	3
Posters	3	2	3	8	4
Leaflets	4	3	2	9	5
Radio	3	1	1	5	6
Drama & songs	4	2	2	8	4
Striga trials	5	5	5	15	1

Table 12: Farmers perception on merits and demerits of learning tools

TOOLS	MERITS	DEMERITS
Rhizotron	Show clearly what is happening underground and the interaction btwn Striga and crop roots. It is effective on trasfering biological knowledge.	Not readily available and it is expensive. Cost of the glass
Field trials	- Participatory in nature -Experiential learning - More incentive i.e. free seeds	Segregation: only few people are involved
Pot exp	Easier to prepare	Effect of *Striga* on roots can not be viewed
Posters	Pictures attract readers / viewers	It is not suitable for illiterate people
Leaflets	Easier to take at home and read anytime/ anywhere	It is not suitable for illiterate people
Drama and songs	Educate and entertaining	Not easy to keep memory / easier to forget
Radio	Heard by many people	Not practical: people don't see actually what is happening

Generally, both villages ranked the *Striga* trials and the rhiztron the first learning tools for educating farmers on *Striga* biology. Also in most cases the pot experiments had scored significantly and hence are considered very crucial for educating farmers. The other tools though have had varying scores from group to group still has key role in educating of farmers the biology *Striga*. Therefore a combination of learning tools is an ideal solution. Also rhizotrons and pot experiments should be promoted as teaching materials and be considered for scaling up in use for other projects.

4.0 Conclusion and Recommendations

4.1 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 the 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 infestation had been noted to increase year after year.

(b) Several sources of agricultural information have been identified. These are researchers, family members, neighbouring farmers, distant farmers (farmer exchange visit) and NGOs. Family members and farmer exchange visits were the most important 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 maximisation. They joined in-groups because of the perceived economic benefits sought.

(d) Rhizotron and Striga trials scores showed that their superior to the others in sending agricultural messages to farmers. However the combination of various learning tools proved to be effective for the learning process.

4.2 Recommendations

The study recommended the following:

(a) There is a need for stakeholders (MAFS & donor agencies) to develop a strategy 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 develop *Striga* control methods, which fit the farmers' socio-economic conditions.

(b) Extension and Research should 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 Village Extension Workers.

(c) There is a need for DALDO office 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.

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