DIVISION OF RESEARCH AND DEVELOPMENT, TANZANIA

DFID CROP PROTECTION RESEARCH PROGRAMME

Increasing cereal productivity on *Striga* infested land

and

Planning for the promotion of improved crop protection in semi-arid areas

A REPORT BASED ON THE PROCEEDINGS OF WORKSHOPS IN LAKE ZONE AND CENTRAL ZONE, TANZANIA - MARCH 2003

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Preface

Striga species, the so-called witchweeds, are widespread on the fields of small holder farmers in semi-arid areas of Eastern and Southern Africa. These noxious parasitic weeds principally attack and reduce the yield of finger millet, maize, sorghum and upland rice in these regions. In many areas it is the crops of resource-poor households, which are affected by these weeds. They impose an additional stress with which people, who have little capacity for investment in crop production, have to cope in an environment characterised by marginal rainfall for cropping and declining soil fertility. Since 1996 staff from the Department of Agricultural Research, and Sokoine University in Tanzania and, Natural Resources Institute and University of Sheffield in UK have been collaborating in studies aimed at developing integrated *Striga* management practices. Studies have been undertaken on-station and on infested farmers fields in affected communities in the Central, Eastern, Lake and Southern Highlands agricultural zones in Tanzania, with laboratory studies at the University of Sheffield. On-farm studies were implemented in collaboration with District Agricultural Extension. The work emphasised:

- the farmer assessment of tolerant sorghum cultivars and cultural practices which reduce the impact of the parasite;
- the development of learning tools which can provide farmers with a greater understanding of the *Striga* problem;
- understanding the differential performance of sorghum cultivars under a range of levels of soil fertility;
- the identification of traits which confer tolerance to *Striga* in maize;
- farmer assessment of cultural practices which reduce the impact of *Sriga* in upland rice

In addition to this research on *Striga* in Tanzania the Crop Protection Programme of the UK Department for International Development has supported work on a number of crop protection issues in semi-arid areas of East Africa. The programme has recently undertaken a review of this work, as a means of identifying opportunities for future promotion and research relating to a cluster of projects on cereals in the region. The overall aim of the review was to assess the role and contribution of cropping to people's livelihoods in semi-arid E. Africa and identify the implications for CPP promotional opportunities and emerging research opportunities to address poverty.

This report documents the outcome of two workshops that were held in Tanzania in March 2003. These brought together research, extension and NGO personnel to disseminate the findings from the *Striga* management project and to obtain the input of these stakeholders to the review and planning of DFID Crop Protection Programme funded activities in semi-arid areas of the country. The workshops were hosted and jointly organized by Mr Robert Tuni (ZRELO) in the Lake Zone and Mr N. Kiariro (ZRELO) in Central Zone. Their efforts made a major contribution towards the success of the workshops. We would also like to thank Mr C.J. Maganga (Lake Zone) and Mr Juma Kayeke (Central Zone) for very quickly and efficiently compiling a first draft of the workshop proceedings.

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CONTENTS

Preface.....2
1. BACKGROUND 4
2. WORKSHOP APPROACH.....4
3. LAKE ZONE WORKSHOP.....4
4.CENTRAL ZONE WORKSHOP.....17
5. CONCLUSIONS AND WAY FORWARD 2727

ANNEX 1 Lake Zone Workshop…….29
ANNEX 2 Central Zone Workshop…….58
ANNEX 3 Workshop presentations…….78

1. BACKGROUND

Since 1996, the Division of Research and Development and Sokoine University in Tanzania and Natural Resources Institute and University of Sheffield in UK have been collaborating on studies aimed at developing integrated *Striga* management practices. This research, funded by the UK Department of International Development Crop Protection Programme (CPP), has been undertaken on-station and on farmer's fields in communities in the Central, Eastern, Lake and Southern Highlands agricultural zones in Tanzania, with laboratory studies at the University of Sheffield. On-farm studies have been implemented in collaboration with District Agricultural Extension. The current project comes to an in March 2003.

CPP has recently funded a review of crop protection issues in semi-arid Tanzania, as a means of identifying opportunities for future promotion and research relating to a cluster of projects on cereals and legumes funded by the programme in semi-arid areas of E. African. The overall aim of the review was to assess the role and contribution of cropping to people's livelihoods in semi-arid E. Africa and identify the implications for CPP promotional opportunities and emerging research opportunities to address poverty. The review has gone through three main steps: A one-day meeting of leaders of current projects in the cluster; a review of published and grey literature and consultations with a wide of range stakeholders. Working papers[1] have been prepared and circulated.

In order to disseminate the results of the *Striga* management project and explore the way forward for promotion of crop protection research outputs in semi-arid Tanzania, two-day workshops were held in Lake Zone and Central Zone in March 2003. The workshops provided an opportunity to present and verify the findings of the review and explore the way forward with a range of stakeholders for uptake of crop protection related research outputs, including recommended *Striga* management practices.

The main section of this report summarises the outcome of the two workshops and makes recommendations for the way forward for the DFID Crop Protection Research Programme. The proceedings of the Lake Zone workshop, the Central Workshop and presentations are set out in the annexes.

2. WORKSHOP APPROACH

The workshops were aimed at stakeholders involved in research and promotion. In Lake Zone participants included researchers from LZARDI, district extension service managers from Mara, Mwanza and Shinyanga regions and representatives from a number of NGOs offering agricultural support services in the zone. A similar group of stakeholders assembled for the CZ workshop and included researchers from Ilonga, Mpwapwa and Hombolo ARIs, extension staff from Singida and Dodoma regions and NGOs representatives. Resource persons, including facilitators were drawn from project partners and DRD Secretariat in Dar es Salaam.

Workshop objectives

1. Disseminate the results of the Striga project in Lake Zone and Central Zone

[1] Lamboll R. Sutherland A. Kavoi J.and Mwanga J.(2003) Review of crop protection issues in semi-arid East Africa, in the context of sustainable livelihoods: A working paper
Lamboll R. And Mwanga J.(2002) Review of crop protection issues in semi-arid Tanzania, in the context of sustainable livelihoods: a working paper. NRI, UK/ DRD Tanzania

2. Validate the findings of a review of crop protection constraints and opportunities in semi-arid Lake Zone and Central Zone
3. Explore the way forward for the promotion of crop protection research outputs
4. Identify future crop protection research areas beyond 2005

Objective 1 Disseminate the results of the *Striga* project in Lake Zone

This was based on presentations of key findings from on-farm, on-station and laboratory based research. The papers (see Programmes in Annex 1 and 2) covered the on-farm performance and farmer evaluation of two short duration sorghum varieties released as Hakika and Wahi, and recommendations on crop and soil management in relation to *Striga* control. Opportunities for use and promotion of varieties and associated management information were explored in stakeholder groups. A range of learning tools evaluated by the project to inform stakeholders of *Striga* biology and control were also presented and discussed.

Objectives 2, 3 and 4 Validate the findings of the SAR; explore the way forward for the promotion of crop protection research outputs and identify future research areas.

These were addressed on the second day of each workshop. The approach followed the following format:

1. Presentations: summary of findings of CPP semi-arid review; examples of on-going initiatives relating to crop protection in the Zones largely from the NGO sector.

2. Identification of further current crop protection research outputs and promotion activities in the Zone: During presentations of on-going initiatives (1 above) a chart showing research issues and outputs was completed on flip chart sheets on the wall.

3. Validation of CPP review findings: *a* specialist group of about eight people was formed in each zone to review and comment on the findings of the SAR report. Group members included senior representatives from research, extension and NGOs.

4. Identification of project themes: *w*orking in small groups current and potential promotion opportunities were identified, together with future research needs from semi-arid areas.

Four main themes for promotion opportunity were explored:
- Promotion of pest, disease and weed tolerant adapted varieties
- Low external input pest, disease and weed management techniques
- Seed management
- IPM for higher value crops

Group tasks

Task 1-Review past and current promotional activities
Working groups consisted of: Researchers, District extensionists in regional groups and NGOs.
Each group was asked to discuss and come to a common understanding of the above themes.
Then, according to the above themes outline past and current activities were identified in their working areas using the following format: Theme, activity, crop protection issues addressed, main implementing agencies, location (districts), when, outcomes and lessons learnt. The results were presented in plenary.

Task 2 Identify future promotion opportunities
Working groups consisted of: 3 mixed groups of extensionists, NGOs and researchers one for each region. Each group was asked to outline future activities in their working areas to address the above themes: using the following format: Theme, activity, crop protection issues addressed, main implementing agencies, location (districts), anticipated outcomes. The results were presented in plenary.

Task 3 Identify future research opportunities
Working groups consisted of three mixed groups of extensionists, NGOs and researchers one for each region. To identify future researchable areas and potential partners the participants were guided by the list below:

1.Cereals - sorghum, millet and maize;
2.Grain legumes: cow pea, green gram, chickpea, pigeon pea and groundnut;
3.Vegetables: tomatoes, onions etc; plant protection on vegetables grown for food/ cash and vegetables grown for seed;
4.Perennials: eg mango, citrus pawpaw and others e.g. Neem, wild species;
5.Agro-chemicals and alternatives knowledge including capacity building and quality control;
6.Climate change and implications for crop management.

The Way forward

In plenary, issues and opportunities were further discussed. The outcome of the two workshops was then collated and used as a basis to identify a way forward for CPP management.

3. LAKE ZONE WORKSHOP

1.Introduction

A workshop was held at Ukiriguru Conference Hall Mwanza on 11th –12th March 2003. Over fifty stakeholders, including researchers from LZARDI, district extensionists from Mara, Mwanza and Shinyanga regions and representatives from a number of NGOs in the zone, participated.

2.Promotion of Striga project research outputs

The major achievement of the *Striga* management project has been the selection and farmer validation of two lines of *Striga* tolerant, early maturing sorghums, Hakika and Wahi. These have been taken through the variety registration and release procedure with the Tanzania Official Seed Certification Agency (TOSCA) and foundation seed is now being multiplied. Following presentation of the merits of these varieties in terms of field performance and farmer acceptability (Annex 3) workshop participants heard from Dr Saadan of the MAFS Seed Unit, of three approaches that have been piloted for local production of Quality Declared Seed. Catholic Relief Services, African Inland Church, the Catholic Diocese of Shinyanga and World Vision presented their experiences of local seed initiatives in Lake Zone (Annex 1). Among the general lessons from these activities are:

- The foundation seed needed to initiate local multiplication is expensive (although price has been brought down this);
- Sources of foundation seed are often far from the areas where projects are set up;
- Group organisation would enable seed treatment;
- It takes considerable time and resources to support seed initiatives;
- It takes time for farmers to develop trust in new sources of seed within the community.

Working groups of extension personnel from each of the three regions represented at the workshop, also indicated in discussions on day two that multiplication and distribution of Hakika and Wahi is now seen as a priority among future promotion activities in a number of districts (see Section 4).

The project was able to report on extensive field and laboratory studies that had been undertaken to determine the performance of Hakika, Wahi and existing sorghum varieties on a range of widely occurring soil types from Lake zone (Annex 3). This work had taken farmers perceptions and classification of soils as a starting point and has provided information on how the various varieties respond to application farmyard manure on different soils in the presence or absence of *Striga*. This work produced the general conclusions that:

- PATO has very high yields at *Striga* free sites when heavily fertilised with manure, but otherwise yields poorly.
- HAKIKA and WAHI are consistently high yielding, and support less *Striga*.
- HAKIKA is preferred over other varieties on extremely infertile and variable Luseni and Itogolo soils which are commonly infested with *Striga*
- WAHI is preferred on more consistent, fertile Mbuga and Ibushi soils although HAKIKA and MACIA are also good choices for these soils.

This information was summarised in a fact sheet, which was distributed to workshop participants. This will form the basis of an extension leaflet to be prepared by the zonal communication Office. The information presented above was also used to develop a simple decision tree to guide extension advice on the choice of the sorghum variety, which is likely to perform best in different situations. This takes into account soil type and presence or absence of *Striga*.

Following these presentations working groups discussed the merits of the decision tree, the fact sheet and considered how these can be incorporated into future district extension programmes. The consensus from the extension groups was that the fact sheet and decision tree will both be very useful and:

- The major strength of both resources is that they bring together information on soils, varieties and *Striga* in one place;
- The main weakness is that other aspects of crop production are not covered and some soils are not included;
- The information should be incorporated into an extension leaflet which is suitable for use at field days, demonstrations and in farmer field schools;
- Village extension officers should be trained in the use of the leaflets and be fully conversant with the information and the decision tree.

The biology of *Striga* is poorly understood by farmers and extension officers but control measures are knowledge intensive. An important component of working with farmers found by the project has been to ensure they adequately understand the life cycle of *Striga.* This knowledge can help with choice and understanding of management practices. A number of learning tools, which can be used by village extension officers to inform farmers about *Striga* biology and control were described, ranging from a rhizatron or pot experiments to posters, leaflets and field plots. There was also considerable interest in other learning tools, particularly the rhizarton. However participants felt that this would be expensive to make and it was suggested that the use of local materials should be investigated.

3.Validation of the Semi-Arid Review

The review summary document had been circulated prior to the workshop, but not the detailed country annexes. A mixed group of eight stakeholders provided a mixture of general and detailed comments. The group emphasised the importance of considering crop protection issues as part of an overall agricultural development strategy. In the context of the Client Oriented Approach, District Agricultural Development plans are being drawn up and it was suggested that crop protection reference should be broad and customized at the individual district level. This would provide an important input for District Agricultural. Development planning, extension and training. The importance of leadership for successful implementation of any strategy was emphasised. It was considered important to emphasise

Post-harvest issues and storage technologies. Labour saving devices for weeding and other farming activities are important from a gender and HIV/AIDS perspective. These comments have been taking into account in planning of the way forward.

4.The way forward for the promotion of crop protection research outputs

The way forward was explored through an analysis of the strengths and weaknesses of the current zonal promotion strategy, review of recent and current activities relating to identified crop protection themes and identification of future activities according to these themes.

Perceived Strengths and Weaknesses of Current Lake Zone Promotion Approach

A number of strengths were identified by all stakeholder groups. However, perceived weaknesses suggest some ideas which may form a basis for building on the current approach. Two of the groups questioned the sustainability of the approach when the current donor support comes to an end. There appears to be a need for further strengthening of links between stakeholders. Promotion coverage is still limited, which is perhaps particularly relevant for semi-arid areas. Some questioned the appropriateness of promotional materials. The importance of marketing and current limited knowledge was raised.

Stakeholder group	**Strengths**	**Weaknesses**
Researcher group	1.Many publication have been made 2.Adequate capacity – Human Resources Materials Financial 3.Well established pathways of collaboration	1. Inadequate dissemination of publication to stakeholders 2.Not sustainable i.e. heavily donor dependent
Mara extension group	1 Stakeholders meetings 2 DMS Workshops 3 Leaflets and other publications available	1 Some information is not available to farmers 2 DMS workshops not adequate 3 Publications are not adequate for farmers
Mwanza extension group	1.It is participatory 2.It is demand driven 3.Capacity building to farmers	1.It is costly in terms of time and money 2.Little knowledge on marketing 3. Not sustainable
Shinyanga extension group	Participatory in:- • Leaflets testing • Researchable areas • Technology testing • Farmers' field day	1. Limited coverage e.g. Bariadi district 2. Weak linkage between Research & councils 3. Shelved Research Results 4. Lack of monetary transparency (CDGF-Cotton Development .Fund)

	• Quarterly workshops • Stakeholders' meetings	
NGO group	1. Promotion agencies are present e.g.Ukiriguru centre, CARE, Kimkumaka etc 2. There are welcoming communities	1. Promotion techniques are not culturally applicable. e.g. Early adopter farmer techniques 2. Total number of promotion agencies has been drastically reduced 3. Promotion agencies are poorly equipped and motivated

Current and recent promotion activities

Theme 1.Promotion of pest, disease and weed tolerant adapted varieties

A number of crop varieties have been promoted in the zone e.g. sorghum, maize and sweet potato. Some varieties are available but in low quantities

Stake-holder group	**Activity**	**Approach**	**CP issues addressed**	**Main agencies**	**Location**	**When**	**Outcome/ lessons**
Research Group	Screening of varieties Maize and sorghum (Tegemeo, Pato, Macia SRN39) Seed multi-plication (Maize + Sorghum)	On-station Approach On-farm Learning centred On-farm Product delivery	*Striga* (Sorghum) Maize streak virus (Maize) Production Of seeds Ensure seed Availability	Ukiriguru ARI Ukiriguru ARI District councils	UK-ARI Misungwi Missungwi (Iteja) village	1997/98 onwards 1997/8 onwards	Outcome S*triga* tolerant varieties *Wahi* and *Hakiki* Dissemination of the varieties
Mwanza group	Seed multi-plication of maize, sorghum, potato vines etc	Product delivery	Use of industrial chemicals and IPM	AICT, CRS, CARITAS Councils and IPM project	Kwimba, Magu, Ilemela, Missungwi Nyamagana district		Availability of more seeds and planting materials

Shinyanga group	Training (Farmers, VEOs)	Farmer Research Groups; Farmer Extension Groups	Clean seed (UK 91)	TCSLB	Kahama Meatu Maswa Shinyanga	1999 2002	Addressed cheating.
NGO group	Multi-plication at Ukiriguru. Distribution	Govt. department to spread to farmers		Consult researchers at Ukiriguru			

Theme 2.Low external input pest management techniques

A number of low input techniques have previously been promoted focusing on addressing declining soil fertility (eg farmyard manure, composting, mulching, green manure). IPM technologies have included pests on cotton and sorghum. Botanicals appear to be available, but perhaps not widely used. The IPM project based in Shinyanga has been a major player in the zone promoting this approach.

Stake-holder group	**Activity**	**Approach**	**CP issues addressed**	**Main Agencies**	**Location**	**When**	**Outcome/ Lessons**
Research Group	Use of fym Intercropping cereal-legume	On-farm learning *Striga* control	*Striga* control “	Extension services Uk-ARI Mlingano-ARI	Missungwi Missungwi	1998 1998	Level of Striga infestation declined Low incidence of striga
Research Group	Use of Botanicals (IPM) Scouting(IPM) Crop Rotation	Product delivery Learning centered Learning centred	American boll worm Stem borer maize + sorghum American ball worm (Cotton) Soil fertility	Uk-ARI Uk-ARI Uk-ARI	Missungwi Shinyanga + Mwanza Shinyanga	1999 1996 1998	Reduces level of infestation Reduction in number of sprays from 6 to 4
Mara group	Training on IPM Techniques	- Learning centred	- Cotton pests - Cassava pest and diseases - Stalk borer on cereals -Botanicals	IPM Shinyanga DALDOs MARAFIP BRAC	Bunda, Musoma Serengeti Tarime	1998 to date	5 IPM groups established in each district
Mara group	Compost making Agro-forestry and inter-cropping.	Learning centred Learning centred	Soil fertility Soil fertility	ARI Ukiriguru DALDO FARMERS VI Agro-forestry project	All districts in Mara	1998 to date	
Shinyanga group	Training – Farmers Agro input supply	Learning centred Stockist Capacity Building	Ox-weeder Decentralization	DRDP, DALDO’s OFFICE -“-	Kahama Meatu Maswa Shinyanga	1996 to date 1998 to date	Fake chemicals
NGO group	Low external input management technology	Increase legume crops - Mulching - Compost	Soil fertility & Pest control Increasing	Kimkumaka + CARE	Mwanza	2000 on going	Many botanicals available but not been used. Cost

		- Green manure - Liquid Manure	soil fertility. Provides resistance to pest and diseases				benefit is high. Teaching the youth is time and cash consuming.

Theme 3.Seed management

Seed management activities have included seed selection, storage and chemical application. Marketing and promotion issues were raised.

Stake-holder group	**Activity**	**Approach**	**CP issues addressed**	**Main Agencies**	**Location**	**When**	**Outcome/ Lessons**
Mara Group	Screening of cassava CMD resistant var.	Learning centred	CMD	ARI-Ukiriguru DALDO IITA	Musoma Tarime	2000	On-farm Trials Farmer Extension Groups/FRGs.
Mara group	Cotton fusarium wilt resistant varieties	Learning centred	Fusarium wilt	ARI-Ukiriguru DALDO	Bunda Musoma	2000	On-farm Trials establishe d
Mara group	Fusarium wilt Survey	Product delivery	- Fusarium wilt	ARI-Ukiriguru MARAFIP DALDO	Bunda, Musoma Serengeti Tarime	1999 2000	Infected areas Identified
Mara Group	Sorghum, maize, beans, cassava, potatoes (S & R), coffee multiplication	Groups	Improved seed	- CCT (Anglican) -MARAFIP - DALDO - ARI-Ukiriguru - Farmers	All-Districts	1997-2002	Improved seeds available. Marketing & promotion needed.
Mwanza group	Seed selection Storage Chemical application	Learning centred	Seed dressing (Fernasan D) Packaging	AICT, CRS, CARTAS, Councils, Farmers	Kwimba, Magu, Ilemela, Missungwi Nyamagana district		

Theme 4.IPM for higher value crops

The IPM project in Shinyanga has been focusing on IPM on cotton, cereals and sweet potato, also safe-handling of pesticides. Some NGOs have been working with alternatives to industrial chemicals taking soil fertility into account together with pest and disease control.

Stake-holder group	**Activity**	**Approach**	**CP issues addressed**	**Main Agencies**	**Location**	**When**	**Outcome/ lessons**
Mwanza group	Cotton scouting	Learning centred	Cultural, biological and chemical control	IPM project	Kwimba, Magu, Ilemela, Missungwi Nyamagana districts		

Shinyanga group	Training farmers	Groups clusters NGO's	- Scouting - Sweet potato weevils -Stalk borer management Ox-weeding - Safe handing of pesticides	PPD GTZ	Lake & western zones	Since 1992 to date	Increased yield
NGO group	Low external input manage ment technolo gy	-Neem tree - Utupa - Cows urine -Ashes -	Insects, fungus viruses	Kimkum aka and CARE			See theme 2.

Future Crop Protection Promotion Opportunities

Mixed groups of stakeholders identified the following crop protection promotion activities according to four themes.

Theme 1.Promotion of pest, disease and weed tolerant adapted varieties

Stakeholders identified opportunities for the promotion of varieties in each of the regions. Sorghum and maize has at least some potential in each of the regions . Also, ACMV resistant cassava. Pigeon pea in Shinyanga. The Shinyanga group, in particular, pointed out the importance of utilization and marketing to enhance opportunities and hence uptake.

Group	**Activity**	**Approach**	**CP issues**	**Main agencies**	**Location**	**Outcomes**
Mara	1. Seed multiplication of *Striga* resistant varieties 2. Cassava multiplication	Product delivery Learning centred	*Striga* resistance CMD/ CGM resistance	Farmers DALDO Research TOSCA DALDO Farmers Research (ARI – Ukiriguru IITA)	Bunda, Musoma Tarime Serengeti Bunda, Musoma Tarime Serengeti	Availability of varieties resistant to *Striga*. Availability of varieties resistant to CMD/CGM. Food security improved
Mwanza	1.Promotion of *Striga* tolerant varieties Sorghum + Maize 2. Multiplication of tolerant varieties	Mass Media/ Large scale Dissemination Product delivery	Pest resistance	NGOs, MAFS Radio, TV	Kwimba Magu Missungwi Ilemela Nyamagana district	Increased community awareness. Increased seed demand.
Shin-yanga	1.On farm seed sorghum, maize, pigeon pea, cassava 2.Processing utilization 3.Marketing	Product delivery	*Striga* Timely Planting Husbandry practices	Farmers Extension NGOs	All districts in Shinyanga	Food security Income

Theme 2.Low external input pest management techniques

Crops mentioned include sorghum, maize and cassava. Use of botanicals. Also ox-drawn implements.

Group	Activity	Approach	CP issues	Main agencies	Location	Outcomes
Mara	Training VEDs and farmer groups on IPM techniques. Cassava Sorghum Cotton Horticultural	Learning centred	Pests and disease control Environ-mental conservation	DALDO Farmers Researchers NGOs	Bunda, Musoma Tarime Serengeti	Pests and disease incidences reduced. Increased yield per unit area.
Mwanza	Exploring a wide range of options appropriate to semi-arid areas eg Stalk borers on maize + sorghum *Ilele* (sorghum midge)	Learning centred	Pest & Diseases	Research extension NGOs	Kwimba Magu Missungwi Ilemela Nyamagana district	Increased product & prolong storage life.
Shin-yanga	Promotion of local fabricators of implements (Ox-drawn) Promotion of botanicals Eg Stalk borers on sorghum -Capacity Building	Product delivery	 Availability of environ-mentally friendly pesticides	Councils (L.A.) NGOs CBOs IPM-Shy	All Districts In Shinyanga All districts in Shinyanga	Labour saving Food security Income Product productio n

Theme 3.Seed management

This was interpreted mainly in terms of village-based seed production, particularly using the 'quality declared seed' approach.

Group	Activity	Approach	CP issues	Main agencies	Location	Outcom es
Mara	QDS Multiplication • Sorghum • Maize • Grain legumes • Pigeon peas • Chickpeas • Groundnuts • Sunflower Processing – Cassava	Learning centered • Musoma, Tarime, Bunda • Tarime Serengeti, Bunda • Musoma, Bunda • Musoma, Bunda • Bunda • Musoma • Tarime+ Serengeti	-Pests, disease and drought resistance.	Farmers DALDO TOSCA NGOs Researchers	Bunda, Musoma Tarime Serengeti	Sustaina ble seed bank Food security Poverty reduction .
Mwanza	High demand for grain legumes		Seed management		Kwimba Magu	

	Sunflower		Quality control		Missungwi Iiemela Nyamagana	
Shin-yanga	Quality control Sorghum Maize Chick peas Groundnuts	Product Delivery	Seed Availability	TOSCA	All districts in Shinyanga	Quality seeds

Theme 4. IPM For higher value crops

In all regions pest and diseases on tomatoes and vegetables were considered significant crop protection problems. Opportunities will vary significantly with location.

Group	Activity	Approach	CP issues	Main agencies	Location	Outcomes
Mara	- Pests and diseases tomatoes and vegetables	Learning centred	Pests and disease control Environmental conservation	DALDO Farmers Researchers NGOs	Bunda, Musoma Tarime Serengeti	Pests and disease incidences reduced. Increased yield per unit area.
Mwanza	- Pests and diseases tomatoes and vegetables	Learning centred				
Shin-yanga	- Pests and diseases tomatoes and vegetables	Learning centred	Availability of environmentally friendly pesticides	IPM-Shinyanga	All Districts in Shinyanga	Low production costs Environment preserved

5. Future Research Areas for semi-arid Lake Zone

There was very little time to discuss this topic. Some potential partners were identified.

Topic	Some current issues	Potential partners
1.Cereals Sorghum Pearl millet Maize	-Sorghum is good for food security, but not a preferred food. Very limited market -P.millet is good for food security and a more popular food but very limited market -Maize is drought prone, but popular food and good market. -(Rice is constrained by soil type and water. Fewer CP problems)	Local Government and NGOs
2.Grain legumes: Cow pea Green gram Chick pea Pigeon pea Groundnut	Chick pea on residual moisture of mbuga soils; cowpea and green gram common, but not major crops, pigeon pea being introduced. Incidence and severity of pests and diseases not well documented Domestic market appears limited and need to further identify international market opportunities.	Vegetables oil industries
3.Vegetables Tomatoes, Onions etc Plant protection on vegetables grown for food/ cash and vegetables grown for seed	Potential impact on livelihoods of women and youth as means of income diversification. Need to clarify who is involved, needs and benefits.	CARE, KIMUKUMAKA TAHEA, CRS and KAHEMP
4.Perennials eg Mango, Citrus,	Trees play multiple roles in livelihoods. Need to clarify who is involved and needs.	

Pawpaw. Others eg Neem Wild species	Crop protection properties of perennial plants	
5. Agro-chemicals and alternatives Knowledge and capacity building and quality control	Cotton and vegetables main user of agro-chemicals. Alternatives being promoted by various agencies.	
6. Climate change and implications for crop management	Global warming,	

4.CENTRAL ZONE WORKSHOP

1. Introduction

A workshop was held CCT Conference Hall Dodoma 14th –15th March, A group of just over forty stakeholders assembled for the Central Zone workshop and included researchers from Ilonga, Mpwapwa and Hombolo ARIs, extension staff from Singida and Dodoma regions and NGOs representatives.

2. Promotion of *Striga* project research outputs

Presentations on the first day of the workshop outlined the selection and evaluation of sorghum lines on a number of *Striga* infested soil types identified by farmers (Appendix 3). This work had led to the registration and release of Hakika and Wahi, two early maturing varieties that are tolerant to *Striga* and have performed well in on-farm trials in Dodoma Urban and Rural districts. Monitoring of farmers who have been involved in project trials over the past 5 years indicated that they have asked for seed of the new lines by other farmers a number of times over the past two years. There is now reported to be growing interest and demand for Hakika, Wahi and the previously released variety Macia. There is considerable experience in Central Zone with local seed initiatives following projects undertaken in more than 60 villages by Diocese of Central Tanganyika (DCT), INADES and District Extension teams with funding from various donors and technical support from ICRISAT and the Agricultural Research Institutes. Experiences have shown that as farmers usually save their own seed it is therefore important to highlight the advantages of quality seed and to provide this at a reasonable price. DCT emphasised the need to treat planting seed and to market this in small packets which clearly labelled as quality declared seed. They have therefore set up a small plant in Dodoma to undertake seed treatment and packing.

Presentations outlined work completed by the project in the field and the laboratory to determine the performance of various sorghum varieties on a range of central zone soils in the presence of *Striga.* Participants were also provided with information on the response of sorghum varieties to manure or urea applications. All of the soils types used by farmers to grow sorghum were found to be extremely low in fertility with particularly low levels of nitrogen, the nutrient which is the key to the damaging effect of *Striga*. The parasite thrives in nitrogen-depleted soils and application of nitrogen in fertiliser or manure can suppress *Striga*. The main conclusion of the studies undertaken by the project at Hombolo and on-farm are:

- PATO has very high yields when heavily fertilised with manure, but otherwise yields poorly.
- HAKIKA and WAHI are consistently high yielding, and support less *Striga*.
- MACIA performs moderately well.

In Central Zone is therefore recommended that:

- HAKIKA be preferred over other cultivars on extremely infertile Isanga chitope, Ngogomba and Nkuluhi soils;
- WAHI be preferred where fertility is higher on some Isanga soils, although Hakika and MACIA are also good choices for these soils.

Studies with fertiliser and manure showed:

- Farmyard manure increases soil quality, generally increases leaf N & P content, increases grain yield, and suppresses *Striga*.

- Urea has a transient effect when applied to Nkuluhi soil, suppressing initial *Striga* growth, but is then leached out of the soil and is unavailable to the crop. If urea is used it applications should be split and not all fertiliser applied to the seedbed.

Central zone extension staff and NGO personnel were provided with copies of a fact sheet outlining the characteristics of Hakika and Wahi and a decision tree to guide extension advice on the choice of sorghum variety which is likely to perform best in different situations. These take into account soil type and presence or absence of *Striga*. Working groups then discussed how this information could be used in future extension work. Both the fact sheet and the decision tree were considered to be useful because both were developed from information obtained from working with farmers. Important comments from the working groups were:

- The strength of the decision tree is that it provides farmers with options and is flexible for a range of recommendation domains;
- The fact sheet was found to be comprehensive in terms of the useful characteristics of the new varieties;
- Further information was requested on any negative attributes of the new sorghums including more on susceptibility to diseases in the field and to pests in storage.
- It was agreed that the information should be incorporated in to extension leaflets and posters. Village extension staff should then be trained on using these.

3. Validation of the Semi-Arid Review

The review summary document had been circulated prior to the workshop, but not the detailed country annexes. A mixed group of stakeholders provided generally detailed comments (eg Pigeon peas 00068 is very susceptible to fusarium wilt). These comments have been taken into account in planning the way forward.

4. Explore the way forward for the promotion of crop protection research outputs

The way forward was explored through an analysis of the strengths and weaknesses of the current zonal promotion strategy, review of recent and current activities elating to identified CP themes and identification of future activities according to these themes.

Perceived Strengths and Weaknesses of Current Central Zone Promotion Approach

A long list of strengths of the current system was provided. However, there was a strong message that research and development has been very focused on production and needs to take into account market opportunities. Dodoma's relatively good access has meant that few research activities are carried out in Singida. The NGO group felt that the overall coverage of promotion activities is limited.

Stakeholder group	Strengths	Weaknesses
Dodoma extension group	1. Quarterly workshops 2. On-farm trials 3. Mass communication 4. Consultation prior release of research outputs 5. Study tours to the fields- ZRELO 6. Seminars in case of outbreaks e.g. Newcastle disease and funds for vaccination 7. Funding for activities from District council 8. Radio programme (Local)	1. Research findings are not delivered at the right time 2.Insufficient funds for quarterly meetings 3.Most of research is on production and not marketing and processing
Singida extension group	1.On-farm trials- sorghum inter-cropping with legumes FYM mixed with Minjingu rock phosphate 2.Seed multiplication – sorghum, cassava, pearl millet 3.Cashew nut promotion- trials and rehabilitation	1.Most of research activities are done in Dodoma Region 2.Research findings are not delivered at the right time

	4.Newcastle Disease control 5.Promotion (topics) identified by extension representing demand of the farmers	
NGO group	1.Use of farmers group 2.Use of demonstration plots (Learning centred approach) 3.Use of biological, cultural methods in pest, diseases and weed control	1.Lack of market for surplus especially sorghum and millet 2.Poor storability of improved varieties (Expensive and unreliable chemicals) 3.Limited coverage

Current and previous promotion activities

Theme 1.Promotion of pest, disease and weed tolerant adapted varieties

The NGO group noted that systems seem to be favouring maize and groundnuts in spite of efforts to promote sorghum, millet and other crops eg in case of famine maize is brought.

Stake-holder group	**Activity**	**Approach**	**CP issues addressed**	**Main agencies**	**Location/ District**	**When**	**Outcome/ lessons**
Dodoma Extension Group	1.On-farm trials	.Product delivery, Farmer group, Mass media	*Striga* and smut control	Research NRI Extension Farmers	Dodoma rural	1998 to date	*Hakika* and *Wahi* varieties. *Striga* control measure by fym and Crotalaria Information dissemination and variety selection
	2.Field days	Farmer group, mass media	*Striga* and smut control	-do-	-do-	-do-	
	3.Demo plots	Farmer group	*Striga* and smut control	-do-	-do-	-do-	
Singida extension group	Seed multi-plication	Product delivery	*Striga* Smut Stalk borer	Research Extension Farmers Primary schools	Manyoni Singida rural and urban Iramba	1996 to date	Drought resistant Early maturing
	Cashew nut trials	Knowledge intensive	Powdery Mildew		-do-	2000 to date	Good taste
Research group	Sorghum smut control	learning centred	Control of smut	ARI-Ilonga Dodoma rural Primary schools SUA NRI	Dodoma rural	1996-2002	Awareness of smut control Better Option identified
	Striga control in sorghum	Learning centred	Mngnt of *Striga* in farmers fields using FYM and	ARI-Ilonga ARI-Mlingano Sheffield University SUA	Dodoma district	1997-2003	Mngt for Striga control identified Resistant variety

	Sorghum Pigeon pea Inter-cropping	Learning centred	resistant varieties Possibly control of *striga*	NRI ARI-Ilonga ICRISAT District councils	Dodoma District	2000 to date	
NGO group	Training Demon-strations Study tours Provisions	Product delivery learning centred Mass media	Smut Armyworm Aphids	DCT/DSCC World vision	Dodoma rural Dodoma urban Kondoa Mpwapwa Iramba	1997 to date DSCC 1991to date world vision	Low uptake of new skills & knowledge by farmers. Dependency syndrome. Not willing to risk and adopt new varieties.

Theme 2.Low external input pest management techniques

Few activities were reported. In their presentation the NGO INADES explained the work they have done documenting and promoting farmers' existing practices to other farmers (Annex 3).

S'holder group	**Activity**	**Approach**	**CP issues addressed**	**Main agencies**	**Location/ District**	**When**	**Outcome/ lessons**
Singida extension group	To advise stockists to supply inputs to farmers	Learning centred	*Striga* control	Stockist Ex worker Farmers	Manyoni Singida rural and urban Iramba	1998 to date	Control of *Striga*

Theme 3.Seed management

Activities include QDS seed production, production of cassava cuttings and smut (sorghum) management.

S'holder group	**Activity**	**Approach**	**CP issues addressed**	**Main agencies**	**Location/ District**	**When**	**Outcomes/ lessons**
Dodoma Extension Group	On-farm seed productio n	Product delivery	Smut Stalk borer Quality control	MAFS Extension Farmers groups TOSCA	Dodoma R Kondoa Kongwa Mpwapwa TOSCA	1998 to date	Seed availability at village level QDS
Singida extension group	Seed multiplica tion	Product delivery	Cassava mealy bug	Ex-worker Farmers NPA	Manyoni and Singida	2000 to date	Cassava cuttings are distributed to farmers
Researcher group	Seed multiplica tion	Learning centred	Control of smut	ARI-Ilonga Dodoma rural Primary schools SUA NRI	Dodoma rural	1996-2002	Awareness of smut control Better option identified

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Future promotion opportunities

Theme 1.Promotion of pest, disease and weed tolerant adapted varieties

A number of crops and varieties were identified as being suitable for promotion including: Sorghum (Hakika, Wahi, Macia, Pato) pearl millet (Okoa, Shibe), Pigeon pea-(MALT 2002), Cow peas (Fahari, Vuli, Tumaini), Cassava (Mumba), Sweet potato (Simama, Sinia) and Maize (Staha, TMVI). In Singida, cashew was emphasised. Storage, packaging and marketing were identified as important issues.

S'holder group	**Activity**	**Approach**	**CP issues addressed**	**Main agencies**	**Location/ District**	**Anticipated outcomes**
Dodoma group	On-farm seed multiplication * Sorghum varieties resistant to S*triga*	Learning centred Learning centred	Control of *Striga* weed	Research Extension Farmers Councils MAFS NGOs	All districts of Dodoma	Adequate resistant seed of sorghum Adequate seed production
Dodoma group	Market promotion for above crops	Learning centred	Storage Packaging	TOSCA Private sector	All districts of Dodoma	Streamline marketing
Singida group	On-farm trials To control Powdery mildew Introduction of resistant varieties	Learning centred (part'patory Product delivery	Powdery mildew in cashew nut	Research Extension Farmers Cashew nut board Primary schools	All districts in Singida	High yields Tolerant varieties to powdery mildew Increased farmers intake
Singida group	To conduct trial on cassava mosaic	Learning centred (part'patory Product	Cassava mosaic	Researcher Extension Farmers	All districts in Singida	Cassava mosaic tolerant varieties

		delivery		Primary schools NPA		

*Varieties: Sorghum- Hakika, Wahi, Macia, Pato
Pear millet: Okoa, Shibe
Pigeon pea- MALI 2002
Cow peas- Fahari, Vuli, Tumaini
Cassava- Mumba
Sweet potato- Simama, Sinia
Maize- Staha, TMVI

Theme 2.Low external input pest management techniques

It was noted by the NGO group that this requires more investment in terms of financial resources and coverage (researchers and dissemination of research outputs). Validation of existing IK approaches was identified as an important issue.. Implementation through a Farmer Field School approach was recommended by the Dodoma group.

S'holder group	Activity	Approach	CP issues addressed	Main agencies	Location/ District	Anticipated outcomes
Dodoma group	Validation (identification) of IK on sorghum, maize, millet, cowpea, pigeon pea. Cassava,HC Dissemination	Learning centred Learning centred	Control of pests (stalk borer and storage) and diseases	Research Extension Farmers Councils MAFS NGOs	All districts of Dodoma	Documented IK practices and methods at village levels Awareness of IK
Dodoma group	Smut control in sorghum FFS in sorghum	Learning centred Learning centred	Control of smut Crop mngt on *striga* and smut	Research Extension Farmers Councils MAFS NGOs	All districts of Dodoma	Awareness of smut problem and chemicals Majority of farmers will adopt the knowledge crop mngt on smut, *striga*, stem borers and other diseases

Theme 3.Seed management

The NGO group emphasised the need for an intensive control system especially when dealing with QDS which can be open to 'loopholes and abuse'. The crops mentioned were similar to Theme 1 with the addition of horticultural crops (currently being produced in Dodoma under the QDS system).

S'holder group	Activity	Approach	CP issues addressed	Main agents	Location/ District	Anticipated outcomes
Dodoma group	On-farm seed multiplication of sorghum, maize, millet, pigeon pea, cow peas, horticultural crops, cassava, sweet potatoes	Learning centred	Resistant to *Striga* Fusarium wilt, Weevils, fungal diseases	TOSCA Private sector	All districts of Dodoma	QDS Clean planting materials for cassava
Singida group	To produce QDS Sorghum Macia, Wahi, Hakika. Pearl millet (Okoa)	Learning centred Product delivery	Seed dressing On-farm seed selection	Researchers Farmers TOSCA Extension	All districts in Singida	Clean seed against smut

				workers Msimba seed farm		

Theme 4. IPM For higher value crops

The NGO group emphasised the issue of the management of chemicals in the current situation of trade liberalisation and a need to enact strict bylaws. Higher value crops listed included horticultural crops (particularly onion in Singida), cashew nut and grapes.

S'holder group	**Activity**	**Approach**	**CP issues addressed**	**Main agencies**	**Location/ District**	**Anticipated outcomes**
Dodoma group	FFS, Cereal crops, Horticultural crops, cashew nut, grapes	Learning centred	Control of pests and diseases	MAFS, NGOs Councils	All districts of Dodoma	High quality and marketable products
Singida group	To conduct trial on blast control on onion	Learning centred Product delivery	Blast control on onion	Researchers Tengeru Farmers Extension workers	All districts in Singida	Blast tolerant varieties

5. Future research areas

The number of ideas and activities were suggested for future research areas. The 'mixed group' comprised researchers, extensionists and NGOs

Cereals: Sorghum, maize, pearl millet

Group		**Researchable areas**	**Potential partners**
Singida group	Cereals: Sorghum, maize, Pearl millet	Diseases in sorghum leaf blight Pests: Storage pests, larger grain borer (maize, sorghum and pearl millet) Utilisation of sorghum Commercialisation of sorghum and pearl millet	ICRISAT, ARI-Ilonga, MAFS, TAHEA, ARI-Hombolo and Private sector
Dodoma group	Cereals: Sorghum and Pearl millet Maize	Breeding palatable varieties by participatory to ensure consumer preference Processing and utilization Storage techniques Marketing and social change Early maturing varieties Better storability High protein maize	Researchers, Extension, MAFS, farmers, NGOs, Stockists and Private sector
Mixed group	Cereals	Post-harvesting technologies on sorghum to improve threshing -Utilisation of *Sorghum* -Storage of maize and sorghum -Drought tolerant varieties of maize e.g. Staha	SIDO, SUA, NARS, NGOs, CBOs, District Councils, Farmers NRI, Funding agencies.

Grain legumes:

Group		**Researchable areas**	**Potential partners**
Singida group	Grain legumes: Chick pea	Agronomic package, spacing, seed rate and post-harvest studies	ICRISAT, ARI-Ilonga, MAFS, Private sector

Group		Researchable areas	Potential partners
Dodoma group	Grain legumes: Cowpea, Green grams, Pigeon pea, Chick pea Ground nuts	Breeding for Consumers preference Early maturing Pest tolerant Breeding for high oil content Storage practises to avoid fungi Processing and marketing	Researchers, Extension, MAFS, farmers, NGOs, Stockists and Private sector
Mixed group	Grain legumes	Studies on yield losses caused by Alectra in cowpea Screen for tolerance to field insect pests in pigeonpea Marketing research on groundnuts and cowpea Varieties, oil content and CP	SIDO, SUA, NARS, NGOs, CBOs, District Councils, Farmers NRI, Funding agencies.

Vegetables:

Group		Researchable areas	Potential partners
Singida group	Vegetables: Tomatoes Onions	Resistant varieties against late and early blight Resistant varieties against leaf blast	ARI-Tengeru
Dodoma group	Vegetables: Tomatoes Onions	Processing and marketing, storability and validation	Researchers, Extension, MAFS, farmers, NGOs, Stockists and Private sector
Mixed group	Vegetables	Post harvest processing to increase shelf life Studies on better packaging eg tomatoes	SIDO, SUA, NARS, NGOs, CBOs, District Councils, Farmers NRI, Funding agencies.

Perennials

Group		Researchable areas	Potential partners
Singida group	Perennials	Varietal development: Mango, Pawpaw	ARI-Tengeru
Dodoma group	Perennials Pawpaw, Grapes, mangoes, Moringa, Neem, Sweet paper (Paprika)	Market survey, validation of technology, Baseline survey, Documentation, Wine processing	Researchers, Extension, MAFS, farmers, NGOs, Stockists and Private sector
Mixed group	Perennials	Testing varieties for adaptation eg mangoes	SIDO, SUA, NARS, NGOs, CBOs, District Councils, Farmers NRI, Funding agencies.

Agro-chemicals

Group		Researchable areas	Potential partners
Singida group	Agro-chemicals	IPM on Cotton	DRD, ARI-Ukiriguru, Private sector and NGOs
Dodoma group	Agro-chemicals	IPM, Capacity building, Quality control of agrochemical	Researchers
Mixed group	Agro-chemicals and alternatives	Validation of available Indigenous Knowledge	SIDO, SUA, NARS, NGOs, CBOs, District Councils, Farmers NRI, Funding agencies.

Climate change

Group		Researchable areas	Potential partners
Dodoma group	Climate	Rain water harvesting, Environment	Researchers,

		(tree planting)	Extension, MAFS, farmers, NGOs, Stockists and Private sector
Mixed group	Global warming	Natural Resource management and RWH -Up-scaling of rain water harvest technologies	SIDO, SUA, NARS, NGOs, CBOs, District Councils, Farmers NRI, Funding agencies.

5. CONCLUSIONS AND WAY FORWARD

Workshops were held in Lake Zone and Central Zone to promote the findings of the CPP/ DRD *Striga* management project and identify opportunities for promotion of crop protection research outputs in semi-arid Tanzania.

The Semi Arid Review (SAR) and subsequent zonal workshops have confirmed that there is a demand from people in semi-arid communities for means of addressing crop protection issues. Possible options to respond come from CBOs, NGOs, government organizations and the private sector.

There are a number of possible partners with, which CPP could work in semi-arid Tanzania for promotion and further research. More strategically, there is an opportunity for CPP to align itself with the Agricultural Sector Development Strategy initiative by enabling development of communication (promotion) strategies in two of the seven DRD research zones: Lake and Central zones. This would provide an opportunity to address longer-term institutional/ process issues, as well as achieving shorter term more tangible aspects of uptake.

The workshops have identified opportunities for scaling up the promotion of CPP research outputs (e.g. *Striga* and Smut management in sorghum) while at the same time supporting broader institutional change to strengthen client-oriented agricultural research to enhance uptake in Tanzania. Each agricultural zone has a Zonal Research Extension Liaison Officer (ZRELO). The ZRELO's office provides a possible CPP project focus for the development of a communication strategy involving public sector extension agencies, NGOs and the private sector.

To help further develop links it is recommended that international NGOs active in Tanzania be invited to co-ordinate a partnership (ZRELO's office, District extension, ARI researchers and other NGOs) in their respective zones to up-scale the promotion of key crop protection outputs, with particular emphasis on local seed supply and low cost crop management practices. Through sub-contracts with the zonal research and development institutes (ZRELO) these projects would also facilitate the further development of the zonal communication strategy as the central component of future dissemination activities.

Options for facilitating liaison between partners of each project should be considered by CPP. This could include the establishment of an East Africa Semi-arid cluster linking to initiatives in Kenya and Uganda. Such an initiative should seriously explore opportunities to develop these links through regionally based longer-term organisations and institutions.

A proposed Central Zone project

During the Central Zone (CZ) workshop, the themes identified through stakeholder consultations under SAR were further discussed and developed. There was particular support for undertaking promotion of new varieties (e.g. *Striga* tolerant sorghum, *Fusarium* resistant pigeon pea), seed management practices (e.g. Smut) and validation of low external input management options, for both low and higher value crops (e.g. use of botanicals and other farmer practices identified by NGOs). Furthermore there was broad consensus concerning the use of a variety of promotional approaches including a) Product delivery b) Learning-centred/ knowledge intensive approaches c) Mass media/larger scale dissemination.

For CZ it was particularly apparent that although a structure, the ZRELO's office, is in place to promote research outputs, the actual activities are not guided by an overall strategic vision. Strengthening the operations of the ZRELO's office through the development of an inclusive and

client oriented zonal communication strategy should be supported. This will encourage the exchange of ideas between stakeholders (eg farmers, District councils, District extension, NGOs, private sector and public sector research) and is considered to be an essential step to enhance the information flow that will be needed to up-scale promotion activities.
Based on this broad consensus it is recommended that CPP funds a project in CZ to develop a zonal communication strategy which incorporates and builds on existing initiatives for product delivery, while piloting innovative approaches to enhance communication between both intermediary organizations and farmers.

A proposed Lake Zone project
During the Lake Zone (LZ) workshop, the themes identified through stakeholder consultations under the SAR were further discussed and developed. As in CZ, there was support for promotion of new varieties (e.g. *Striga* tolerant sorghum and maize, *Fusarium* resistant pigeon pea, ACMV resistant cassava, chick peas, sunflower), seed management practices (e.g. Smut) and of low external input management options, for both low and higher value crops (e.g. stalkborer control on cereals, use of botanicals). Again, as in CZ, there was broad consensus concerning the use of a variety of promotional approaches including a) Product delivery b) Learning-centred/ knowledge intensive approaches c) Mass media/larger scale dissemination.

For LZ it was apparent that the ZRELO's office already has an overall strategic plan developed over a number years with support from the Dutch funded COR project. The zonal workshop identified a number of strengths including: Demand driven, participatory, capacity building for farmers, many leaflets and other publications, stakeholder meetings, farmers' field days. Weaknesses are perceived to be: the system is costly in terms of staff time and money, insufficient focus on markets, not always culturally applicable, some promotion agencies are poorly equipped and motivated, not all publications are appropriate for farmers, concern that the system may not be sustainable in absence of donor funding. Direct Dutch support is due to end in June 2003, although there may be continued indirect support to the COR process through district councils. There is a clear opportunity to build on the achievements of the zonal programme by addressing the weaknesses in the zonal communication strategy identified above. Based on this broad consensus it is recommended that CPP funds a project in LZ to further enhance an already successful zonal communication strategy and piloting innovative approaches to enhance communication between both intermediary organizations and farmers. Similar draft outputs are suggested for CZ and LZ although there will clearly be differences in emphasis.

Draft outputs
1 Demand areas for crop protection research outputs validated
2 Approaches for improving stakeholders' access to research outputs identified
3 Methods for delivery of research outputs to uptake pathways piloted
4. Methods for sustaining feedback and updating demand identified/piloted
5.Monitoring and learning about process documented

Communication specialist to support the projects
It is recommended that the development of zonal communication strategies in both projects should be supported by inputs from an organization with expertise in both communication between organizations and promotion of information to end-users.

Monitoring and evaluation
In order to maximise benefits of lesson learning, M and E activities will be key. This is likely to need external inputs.

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ANNEX 1

PROCEEDINGS OF LAKE ZONE *STRIGA* AND CROP PROTECTION SEMI-ARID REVIEW WORKSHOP

11^{TH} –12^{TH} MARCH 2003

ARI UKIRIGURU CONFERENCE HALL, MWANZA

ARI Ilonga/NRI/SUA *Striga* Management Project/ CPP Semi arid review
Programme for Zonal *Striga* workshops
11th –12th March 2003 – Ukiriguru Conference Hall Mwanza:

8.30 –9.00 Registration

Chairman Mr. Tuni (ZRELO Lake Zone)

9.00- 9.15 Opening remark
Zonal Director Lake zone
Introduction to project themes
N. Lema
9.15 – 9.45 Introduction to aims and activities of the project
Dr Riches - NRI
9.45 – 10.00 The Striga Situation in Tanzania
Dr Mbwaga – ARI, Ilonga

10.00 –10.30 Tee/Coffee Break

Chairman: R. Kileo Zonal Research Coordinator Lake Zone

10.30 – 11.00 Performance and release of new Striga tolerant/resistant sorghum varieties
Dr Mbwaga – ARI, Ilonga
11.00-11.15 Option for multiplication and distribution of new varieties in the zone
Dr Saadan – MAFS Seed Unit.
11.15 – 12.00 Discussion on seed multiplication Facilitated by R Lamboll
12.00- 12 30 Crop and soil management using resistant sorghum varieties
Dr Ley – ARI, Mlingano; Dr Pierce – Sheffield University, UK
12.30 –13.00 Learning tools for farmer understanding of Striga biology and control
Mr Nyankweli - SUA

13.00 – 14.00 LUNCH

Chairman Dr. J. Hella - SUA Morogoro

14.00 –14.30 Decision trees for management of Striga infested fields
Dr Pierce - Sheffield University, UK
14.30 – 15.30 Small group discussion on use of decision trees, learning tools etc
Facilitated by N. Lema and R. Lamboll

15.30- -16.00 Soft Drinks

CHAIRMAN DR. A. M. Mbwaga

16.00- 16.30 Small group presentations on use of decision trees, learning tools etc

16.30 - 17.00 Reflections on Striga research and development
Dr Mitawa – MAFS

Day 2 Review of crop protection issues and promotion opportunities

CHAIRMAN DR. G. Ley

8:00a.m. Results of review of crop protection issues in Semi-arid Tanzania
R. Lamboll – NRI and J. Mwanga – LPRI, Mpwapwa

8:30a.m. Recent outputs from Crop Protection research at LZARDI Ukiriguru
J Sato (LZARDI, Ukiriguru)

9:15a.m. Zonal research information management, zonal linkage and liaison monitoring: Towards extension and dissemination
R S. Tuni (LZARDI, Ukiriguru)

9:30a.m. Farmer Field Schools in Kagera; Experiences and issues
T Julianus (FAO, Bukoba)

9:45a.m. CRS crop protection-related activities in Semi-arid Lake Zone
D. Rwegoshola (CRS, Mwanza)

10:00a.m. Tanzania Home Economics Association household food security and technology transfer project
Asia Kapande. (TAHEA, Mwanza)

10.15 Tanzania/ GTZ IPM project: Experiences and issues
Joshua Muro (IPM Shinyanga)

10:30a.m. Coffee/ Tea-break
Facilitation N. Lema and R. Lamboll

11:00a.m. Group work identification of demand from stakeholders

12:00noon Presentations

1:00p.m. Lunch break
Facilitation N. Lema and R.Lamboll

2:00p.m. Further group work
Presentations

3:00p.m. – 3:30p.m. Closure and departure

1. Welcome and opening remarks

Mr. P. Kapingu

The Zonal Director Lake Zone Agric. Research Institute.

Mr. Chairman, Guest of honor, invited guests, ladies and gentlemen.

First of all I would like to welcome you all in our zone, and above all to welcome you all at the Lake Zone Agricultural Institute here at Ukiriguru. Mr. Chairman, we are here today to share our experiences pertaining to sorghum and, sorghum related aspects in general. The importance of sorghum in our zone does not need to be over emphasized, because apart from its being a drought tolerant crop, it is among the cereals used as a staple food to most of our people.

It is therefore my pleasure that this workshop has been convened at the right time. This is because the current meteorological reports are giving an indication that we will be experiencing a drought catastrophe this year. Thus, noting that sorghum is being addressed today gives me and the entire Lake Zone community great pleasure, as we hope that our difficulties, food shortage, as a result of drought which is just around the corner will have found a solution in one way or another.

Dear Ladies and Gentlemen, I wish you a fruitful workshop.

2. Workshop themes

Mr. Ninatubu Lema.

DRD HQ, Dar es Salaam

The workshop has two major purposes. On the first day the team of the DFID funded *Striga* management project will present their findings and discuss with district extension staff and NGOs the opportunities that exist for promoting recommendations on increasing productivity of *Striga* infested fields to farmers. The second day will be devoted to a more general review of the current promotion activities being undertaken by a number of organizations in Lake Zone. Following a review of crop protection outputs ready for dissemination the meeting would focus on opportunities to undertake promotion work with farmers over the coming two years and then to consider topics on which further research may be needed beyond 2005. This time horizon reflects the current cycle of funds, which may be available from the DFID Crop Protection Programme for the support of promotion activities in semi-arid Tanzania.

Objectives of the workshop

- Disseminate the results of the *Striga* project in Lake zone
- Validate the findings of a review of crop protection constraints and opportunities in semi-arid Lake Zone.
- Explore the way forward for the promotion of crop protection research outputs
- Identify research opportunities for beyond 2005.

Self-introductions

Workshop participants introduced themselves, starting with their names, area of their specialties and where they come from. This was followed by their expectations of the workshop (See Appendix 1 and 2).

3. Introduction to aims and activities of the DFID CPP Management Project

Dr. C. Riches, *Striga* project leader, Natural Resources Institute UK.

See Annex 3 Paper A.

4. Status of *Striga* situation in Tanzania.

Dr. A. Mbwaga, In-country co-ordinator, *Striga* management project

See Annex 3 Paper B.

Following a summary of the occurrence and distribution of *Striga* in the country, the biology of the parasite and a brief review of a number of the initiatives taken to develop control measures, Dr Mbwaga answered the following questions.

Question 1.
Is it true that there is no *Striga* in Kagera? Or has no research been done?
Answer.

- Kagera is a high rainfall area. These conditions are unfavorable to *Striga* species.
- *Striga* is generally a weed in semi-arid areas but is expanding into semi-humid areas. We have not covered Kagera in our surveys, it is likely that Striga is there in dry areas like Ngara district.

Question 2
1. What is the use of crop rotation for *Striga* control?
Answer.
Rotation is by legumes that enhance germination but do not support *Striga* growth and hence deplete *Striga* seed bank in the soil.

Question 3
Striga attacks maize sorghum, millet and rice. What about Bulrush millet?
Answer
Bullrush Millet is not affected by the Striga species found in the country but elsewhere like West Africa Pearl millet is attacked by Striga.

Question 4
Clarification on control of *Striga* with regards on planting dates?
Striga is it indigenous weed in Tanzania?.
Answer.
Early planting can, if rainfall is early, allow the crop to escape *Striga* infestation. However this can also increase risk so it is a good idea to only plant part of the crop early.
Yes, *Striga* is indigenous across much of Africa and the problem been known in Tanzania for decades, back to at least the1950s when there was research at Ukiriguru by Doggett.

Question 5
Any objectives/strategies on intensive education available to the farmers?.
Answer.

- The project conducted seminars for farmers in participating villages.
- Leaflets and posters prepared by different projects are available, along with a manual describing the biology and control of *Striga.*
- The important thing is for the farmer to know the distribution, biology and how to control the problem, for instance by early weeding.

6. Performance and release of new *Striga* tolerant sorghum varieties

A. M. Mbwaga, ARI, Ilonga

See Annex 3 Paper C.

7. Options for seed multiplication and distribution of new varieties in the zone

H Saadan, Seed Unit, MAFS, Dar es Salaam

Annex 3. Paper D.

8. Discussions on options for seed multiplication and promotion of Hakika and Wahi

Facilitated by N.Lema and R. Lamboll.

Following the presentation by Dr Saadan, which explained three community based approaches for the production of Quality Declared Seed, discussion followed on the current situation for seed provision in Lake Zone. The following organizations were identified as having been involved in seed production in Lake Zone:

- TAHEA
- Catholic Relief Services
- African Inland Church - BUNDA
- AIC - MUSOMA
- CATHOLIC DIOCESE - SHINYANGA
- WORLD VISION – SHINYANGA.

Some of the organizations present provided the following information:

Organ-	**AIC (African Inland Church)**	**Catholic Relief Services.**	*TAHEA Mwanaza*
Partiners	Misungwi & Kwimba District Extension	Shinyanga catholic diocese; Mbulu catholic diocese; the NGO Kimkumaka in Mwanza district	District Extension staff ARI Ukiriguru (Released Sweet Potato vines) MATI Ukiriguru (for farmers residential training) TAWLAE TSAEE Funded by CARE Tanzania and by CIP Kampala
Location	Misungwi & Kwimba 6 villages 20 farmers each	Maswa/Bariadi and Kishapu districts in Shinyanga region; Babati district in Arusha region.	Missungwi & Nyamagana Districts Two villages (Mwasonge In

Organ-	**AIC (African Inland Church)**	**Catholic Relief Services.**	*TAHEA Mwanaza*
			Missungwi District; Luchelele in Nyamagana District).
Varieties	Sorghum Firstly Tegemeo, more recently Pato Maize Katumani and then Kilima/TMV1/Staha	Pigeonpea –ICEAP 00068, ICEAP 00554, ICEAP 00557 Groundnut—Pendo, Nyota, Johari, Sawia	Simama, Sinia. Juhudi, Polysta & Orange Fleshed S. P.
Quantity production	50 bags minimum year/village depending on weather Packaging – plastic bags with labels (provided by project)	• Only one farmer per district • One acre of land • Quantity produced not yet known because seed were planted in December 2002	Over 2000 bags of sweet potato vines. Over 5000 bags of sweet potatoes
Approach	Seed to participating farmers and surrounding farmers (isolation) Tosca training of producers	• Farmer selected by the partners and collaborations • Selection criteria: Education, land availability, commitment, dedication and interest.	Farmers groups 10 groups of 10 farmers per group in each village
Years	1998 onwards	2002 (December)	2000-2002
Coverage e.g. no of villagesS	6 villages 20 farmers/village	Only three villages one in each district; four farmers.	200 farmers directly and over 2000 people Indirectly.
Lessons learnt	• Foundation seed is expensive (needed donor help) • Farmers did not initially trust seed because they are cheap and produced by neighbors • Storage – group seed bank – treated with pesticide • Can certify at ward level	• Foundation seeds are expensive • Sources of seeds are very far away • Collaboration with research Institute ARI Ukiriguru and Selian and Agric department is helpful	(i) Expensive project (ii) Needs facilities for irrigation for sustainability (iii) Needs Diligent personnel for better success (iv) Needs a lot of time
Objectives comments	• Food security • Price of foundation seed now produced by government is 3000/kg	• Food security • Income security • Support women in their initiatives.	Household Food security and technology transfer

9. Crop and soil management using resistant sorghum varieties

S. Pierce (Sheffield University, UK); G Ley (ARI Mlingano)

See Annex 3. Paper E.

10. Learning tools for farmer understanding of *Striga* biology and control

E M Nyankweli. and A.Z. Mattee (SUA, Morogoro); E.A. Mwageni (ARI Mpapwa)

Annex 3 Paper F

11. Group discussion on sources of information to support the promotion of *Striga* management practices

Facilitated by N.Lema/ R. Lamboll

Following the presentations on the new sorghum varieties and supporting information the meeting discussed ways in which a series of training resources that are now available could be used in future extension programmes. Participants were divided into the following groups:

- Shinyanga extension
- Mara extension
- Mwanza extension
- Researchers
- NGO+FAO

Each group was then asked to assess the crop and soil management tools and the learning tools as follows.

1. CROPS AND SOIL MANAGEMENT.
- Decision tree
- Fact sheet on varieties
- Other information

2. LEARNING TOOLS.
- Tools e.g. the rhizotron, pot experiments, field plots
- The approach used by the project to asses the tools

Task.

Each group was asked to consider the following:

a Is this information useful in your work?. Yes/No
b If yes, how would you use it?
c What are the strengths?
d What are the weaknesses?
e How can it be improved ?
f How would you take forward?

Table of group presentations

	Shinyanga region group	**Mara region group**	**Mwanza region group**	**NGO + FAO group**	**Researcher group**
1. Crop and soil management					
Decision tree					
(a)Is this information useful in your work? Yes/no	Yes	Yes	Yes	Yes	Yes it is useful information
(b)If yes, how would you use it	To make decision on which fertilizer/seed variety to use in different soils & *Striga* prone areas & *Striga* free area	How to use it? .	Recommended sorghum cultivars according to soil type and fertilizers (manure)	To apply the decision tree fact sheet information on variety and learning tools in our work	To develop flexible recommendation To recommend domains**.**

	Shinyanga region group	**Mara region group**	**Mwanza region group**	**NGO + FAO group**	**Researcher group**
	Training (Farmer group). Leaflets.		available.	and disseminate it to farmers e.g. in deciding what sorghum variety to plant in a particular soil type with *Striga*	
c) What are the strengths?	Easy to understand useful in making decision with regards to soil type. Inputs (Fertilizer and seeds).	All types of soil mentioned are present in Mara as well as *Striga* Guide to decide sorghum varieties to be grown Useful in all types of soils	One decision combines three variables e.g. soil type, seed varieties and type of fertilizers or manure.	Provides decision making information on sorghum production in the soil infested with *Striga* . Provide alternatives	Easy to use Cheap way – transmitting information Better chances for recommendations to be adopted. Potential to be used in large scale.
(d) What are the weaknesses?	As no expose to different soil types.	FYM not available in Luseni soils UREA is very expensive.	It doesn't cover many aspects of crop husbandry e.g. rainfall requirements.	Considers only four types of soils Chemical fertilizer use not exhaustive.	Over simplified Overlooked cost factors
(e) How can it be improved	Include other soil types e.g Kikungu.	Introduction of Hakika, Wahi, Pato and Macia. Farmer and VEO training (Demonstration and trials).	(e) Can be improved by addition of other crop husbandry practices.	Inclusion/incorporate of more soils and fertilizers in the decision tree.	To include B-C analysis Split UREA/no fertilizer box.
(f) How would you take forward?	Use of demonstration plots Farmer training Farmer Field School.	L	Community sensitization		Change and test it.
Fact sheet on varieties		.			
(a)Is this information useful in your work?. Yes/no	Yes	Yes		Yes	
(b)If yes, how would you use it	The introduction of Wahi & Hakika will help to boost production of				

	Shinyanga region group	Mara region group	Mwanza region group	NGO + FAO group	Researcher group
	sorghum in *Striga* prone areas As a leaflet to stakeholders.				
c) What are the strengths?	Has sufficient information on the use of Hakika and WAHI	Simple to use		Provides useful information of fertilizer application to suppress *Striga* in a sorghum field.	
(d) What are the weaknesses?	Other important parameters not documented e.g. Resistance to diseases. Fact sheet Other information: Recommendation; fertilizers etc.	Other factors not considered e.g. bird attack. Hakika, Wahi and Pato are not available.			
(e) How can it be improved	Coloured leaflets.				
(f) How would you take forward?	Use of community based groups (Quality declared seeds).	.			
2. LEARNING TOOLS.					
Tools					
(a)Is this information useful in your work?. Yes/no	YES	Yes	YES	Yes	YES it is useful information
(b)If yes, how would you use it	For training purposes Rhizotron Field trials Pot experiment	Farmers and VEOs training Create awareness	To educate farmers.	Farmers and VEOs training on *Striga* awareness and control. Create awareness Effective Participatory Expensive. Some not known	To select appropriate tool for farmer categories.
c) What are the strengths?	(Participatory	Effective Participatory	It is participatory	Provide merits and demerits of each tool. Provide information on alternative tools to disseminate	Complement each other.

	Shinyanga region group	Mara region group	Mwanza region group	NGO + FAO group	Researcher group
				information to farmers on management and control of *Striga*.	
(d) What are the weaknesses?	Expensive In small groups (coverage)	Expensive. Some not known Adequate funding	Expensive Time consuming Covers small population (Rhizotron)	Some of the tools can't easily be adopted by farmers.	Some are limited to capacity to read and write (e.g. poster, leaflet. Cost element Too involving (e.g. Field trials) Limited in scope (Few farmers) Some not sustainable
(e) How can it be improved	Reduce the size of Rhizotron	Training Test the learning tools in different area		Adequate funding Training Tours Farmers training (FFS, FEG and FRG) Researchers to conduct on-farm trials for Hakika, Wahi and Pato in Mara region	Some- to use locally available materials.
(f) How would you take forward?	District resource centers (establishment).	Tours. Farmers and VEOs training (FFS/FRG/FEG). Researchers to conduct on farm trial.	Creating community measures.	Sensitize other stakeholders on these tools. Apply the tools in our day to day activities in *Striga* management and control.	Test, multiply and disseminate

12. Reflections on *Striga* research and development

Dr. Mitawa (DRD Secretariat, Dar es Salaam)

See Annex 3. Paper G

DAY 2: REVIEW OF CROP PROTECTION ISSUES AND PROMOTION OPPORTUNITIES IN CENTRAL ZONE

1. Results of review of crop protection issues in semi-arid Tanzania, in the context of sustainable livelihoods

R Lamboll (Natural Resources Institute, University of Greenwich) and J.Mwanga (DRD, LPRI Mpwapwa)

See Annex 3. Paper H

2. Recent outputs from Crop Protection research at LZARDI Ukiriguru

J Sato (Lake zone Agricultural Research and Development Institute, Ukirigiru)

See Annex 3 Paper I.

3. Zonal research information management, zonal linkage and liaison monitoring: Towards extension and dissemination

R S. Tuni (Lake zone Agricultural Research and Development Institute, Ukirigiru)

See Annex 3 Paper J

4. Farmers Field Schools activities in Kagera

T Julianus (FAO) Bukoba

See Annex 3. Paper K

5. Catholic Relief Services activities in Lake Zone

D. Rwegoshola (Catholic Relief Services, Mwanza)
B. Polkinghorne (KIMKUMAKA)
See Annex 3 Paper L

Tanzania home Economics Association (TAHEA) Household food Security and Technology Transfer project

Asia Kapande. (TAHEA, Mwanza)

See Annex 3. Paper M.

Crop protection promotion opportunities identified during the workshop

The following were identified from CPP projects that have been operational in East Africa and from work completed by LZARDI in Tanzania.

ISSUE	**OUTPUT**
Groundnut Rosette	Resistant varieties
Finger millet Blast	Resistant varieties
Sorghum pest A. Stalk borer B. Midge C. Weeds	Tolerant varieties Stover management Time of planting Panicle management DAP Weeders
Striga A. Sorghum B. Maize	Resistant/tolerant varieties Intercrops Manure
Maruca pod borer on Cowpea	Pheromone traps Botanicals
Sorghum Smut	Seeds Sanitation
Cassava CMD CGM	Varieties Mites
Sweet potato Weevil Virus	 Hilling-up Varieties
Cotton pests	Scouting IPM Botanicals
Rice RYMV	Not yet available
Maize Streak	Varieties

Group work

TASK 1-Review past and current promotional activities in Lake Zone

Working groups consisted of:-

- Researchers
- District extension- split into Shinyanga, Mwanza and Mara regions
- NGOs

Each group was asked to:

- Identify 3 strengths and 3 weaknesses of the Lake Zone approach to promotion.
- Discuss and come to a common understanding of the following themes in promotion work
  1. Promotion of pest, disease and weed tolerant adapted varieties;
  2. Low external-input pest management practices;
  3 Seed management
  4. IPM for high value crops
- According to the above themes outline activities past and current in your working areas using the format below

Theme	**Activity**	**Approach**	**Crop protection issues addressed**	**Main implementing agencies**	**Location (districts)**	**When**	**Outcomes and lessons learnt**
1.	1						
	2						
	3						

RESEARCH GROUP TASK 1

Strengths and weaknesses of the Current Lake Zone Approach to Promotion.

Strengths	Weaknesses
1. Many Publication been made 2. Adequate capacity – Human Resource Materials Financial 3. Well established pathways of collaboration	1. Inadequate dissemination of publication to stakeholders 2. Not sustainable i.e. heavily donor dependency

Theme	**Activity**	**Approach**	**Issue addressed**	**Agencies**	**Location**	**When**	**Outcome & lessons**
Pest tolerant adapted varieties	Screening of Varieties (Sorghum)+ Maize (Tegemeo,	On-station Approach On-farm	*Striga* resistant (Sorghum) Maize streak virus	Ukiriguru ARI	UK-ARI Misungwi	1997/8	Outcome *Striga* tolerant verities Wahi,

Theme	Activity	Approach	Issue addressed	Agencies	Location	When	Outcome & lessons
	Pato, Macia) Sorghum varieties) SAR,29 Seed Multiplication (Maize + Sorghum)	Learning centered On-farm Product delivery	(Maize) Population of seeds Ensure seed availability	Ukiriguru ARI District council	 Missungwi (Iteja) village	 1997/8	Hakika Disseminati on of the varieties
Low external-input manage-ment practices;	Use of fym Intercropping cereal-Legume	On-farm learning *Striga* control	*Striga* Control “	Extension services Uk-ARI Mlingano-ARI	Missungwi Missungwi	1998 1998	Level of Striga infestation decline “ Low incidence of *Striga*
IPM for higher value crops	Use of Botanicals (IPM) Scouting(IPM) Crop Rotation	Product delivery Learning centered Learning centered	American boll worm Stalk borer (maize + sorghum) American ball worm (Cotton) Soil fertility	UK-ARI -“- -“-	Missungwi Shinyanga + Mwanza Shinyanga	1999 1996 1998	Reduces level of infestation Reduction in number of sprays from 6 to 4

TASK 1 MARA EXTENSION GROUP

Strengths	Weaknesses
- Stakeholders meetings - DMS Workshops - Leaflets and other publications available	- Some information are not available to farmers - DMS workshops not adequate - Publications are not adequate to farmers

Theme	Activity	Approac h	Issue	Agencies	Location	When	Outcome & lessons
Pest tolerant adapted varieties .	1.Screenig of cassava CMD resistant var.	Learning centered	CMD	ARI-Ukiriguru DALDO IITA	Musoma Tarime	2000	On-farm Trials Farmer Extension Groups/FR Gs.
	2. Cotton Fusarium wilt resist-Vs	- Learning centered	Fusarium wilt	ARI-Ukiriguru DALDO	Bunda Musoma	2000	On-farm Trials established
	3. Fusarium wilt survey	- Product delivery	- Fusarium wilt	ARI-Ukiriguru MARAFIP DALDO	Bunda,Mus oma Serengeti Tarime	1999 2000	Infected areas Identified
Low external	Composite making	Learning centered	Soil fertility	ARI Ukiriguru	All districts in Mara	1998 to	

Theme	Activity	Approach	Issue	Agencies	Location	When	Outcome & lessons
-input management practices	3.Agro-forestry and intercropping.	Learning centered	Soil fertility	DALDO Farmers, VI Agroforestry project		Date	
Seed management.	Sorghum, maize beans cassava potatoes (S & R) coffee multiplication	Groups	Improved seed	- CCT (Anglican) - MARAFIP - DALDO - ARI- UKIRIGURU Farmers	All-Districts	1997-2002	Improved seeds available. Marketing & promotion needed.
IPM for higher value crops	4. Training on IPM techniques	Learning centered	- Cotton Pests - Cassava pest and diseases - Stalk borer on cereals - Botanicals	IPM Shinyanga DALDOs MARAFIP BRAC	Bunda,Musoma Sereneti Tarime	1998 to Date	5 IPM groups established in each district

MWANZA EXTENSION GROUP TASK 1

Strengths	Weaknesses
It is participatory It is demand driven Capacity building to farmers	It is costly in terms of time and money Little knowledge on marketing Not sustainable

Theme	Activity	Approach	Issue	Agencies	Location	When	Outcome & lessons
Pest tolerant adapted varieties	Seed multiplication of maize, sorghum, potato vines etc	Product delivery	Use of industrial chemicals and IPM	AICT, CRS, CARITAS, Councils and IPM project	Kwimba, Magu, Ilemela, Missungwi Nyamagana districts	Not reported	Availability of more seeds and planting materials
Seed management	Seed selection Storage chemical application	Learning centered	Seed dressing (Fernasan D) Packaging	AICT, CRS, CARTAS, Councils, Farmers	As above	Not reported	
IPM for higher value	Cotton scouting	Learning centered	Cultural, biological and chemical	IPM project	As above	Not reported	

crops							

SHINYANGA GROUP TASK 1

Strengths	**Weaknesses**
Participatory in: • Leaflets testing • Researchable areas • Technology testing • Technology testing • Farmers' field day • Quarterly workshops • Stakeholders' meetings	• Limited coverage e.g. Bariadi district • Weak linkage B/N Research & councils • Shelved Research Results • Lack of monetary transparency (CDGF-Cotton Dev Fund)

Theme	**Activity**	**Approach**	**Issue**	**Agencies**	**Location**	**When**	**Outcome & lessons**
Pest tolerant adapted varieties	Training (Farmers, VEOs)	FRG, FEG, (b)	Clean seed (UK 91)	TCSLB	Kahama Meatu Maswa Shinyanga	1999 2002	Cheating.
Low external-input management practices	Training farmers Agro input supply	Learning centers Stockest Capacity Building	Ox-weeder Decentralization	DRDP, DALDO's Office -"-	-"- -"-	1996 to date 1998 To date	 Fake chemicals
IPM for higher value crops	Training farmers	Groups clusters NGO's	Scouting S.P.weevil Stalkborer mg'nt Ox-weeding Safe handing of pesticides	PPD GTZ	Lake & western zones	Since 1992 To date	Increased yield

NGO GROUP TASK 1

Strengths	**Weaknesses**
Promotion agencies are present E.g.Ukiriguru Center, Care Kimkumaka etc There is a welcoming community	Promotion techniques are not culturally applicable. E.g. Early adoptors of farmer techniques Total number of Promotion agencies has been drastically reduced Promotion agencies are poorly equipped and motivated

Q 2. Common Understanding

1. Pest tolerant varieties-some varieties are available but in low quantity

2. Low external input management technology -this is a new idea in the area and poorly understood. Production but been poorly implemented

3.Seed management-seed management seems to be not a big problem in our area

4. IPM for high value crops-IPM is needed in tomato and other horticultural crops

Theme	**Activity**	**Approach**	**CP issues addressed**	**Main agency**	**When**	**Outcome/lessons**
Pest tolerant adapted varieties	Multiplication at Ukiriguru. Distribution	Government Department to spread to farmers	Consult researches at Ukiriguru			
Low external-input management practices	- Soil fertility - Pest control	- Increase legume crops - Compost - Green manure - Liquid Manure - Azolla - Tithonia green manure	- Increasing sold Fertility. - Produces resistance to pest and diseases	Kimkumaka + CARE	2000 on-going	Many Botanicals available but not been used. Cost benefit is high Teaching the youth is time and cash consuming
IPM for high value crops		- Neem tree - Utupa - Cows Ashes	Insect fungus virus			

TASK 2 Identify future promotion opportunities

Working groups consisting of:
3 mixed groups of extensionists, NGOs and researchers one for each of Shinyanga, Mwanza and Mara regions

- Outline future activities in your working areas to address the above themes

Theme	Activity	Approach	Crop protection issues addressed	Main implementing agencies	Location (districts)	Anticipated outcomes
1.	1					
	2					
	3					

Present in plenary

MARA EXTENSION GROUP TASK 2

Theme	Activity	Approach	CP Issues	Agencies	Where	Outcome
Pest tolerant adapted varieties	1. Seed multiplication *Striga* Research varieties (cereals)	Product delivery	*Striga* resistance	Farmer DALDO Research TOSCA	All districts	Availability of resistant varieties to *Striga*.
	2. Cassava multiplication	Learning centered	CMD/CGM resistance	DALDO Farmers Researchers (ARI Ukiriguru IITA)	Bunda, Musoma Tarime Serengeti	Availability of resistance Vs to CMD/CGM Food security improved
Low external-input management practices	1. Training VEDs. And Farmer group on IPM techniques. Cassava Sorghum Cotton Horticultural	Learning centered	Pests and disease control Environmental conservation	DALDO Farmers Researchers NGOs	Bunda, Musoma Tarime Serengeti	Pests and diseases incidences reduced Increase yield per unit area.
Seed management	1.QDS Multiplication • Sorghum • Maize • Grain legumes • Pigeon peas • Chickpeas • Groundnuts • Sunflower	Learning centered • Musoma, Tarime, Bunda • Tarime Serengeti, Bunda • Musoma , Bunda • Musoma, Bunda • Bunda • Musoma • Tarime+ Serengeti	-Pests, disease and drought resistance.	Farmers DALDO TOSCA NGO Researchers	- do -	Sustainable seed bank Food security Poverty Reduction.
	-Processing	- Cassava				

IPM for higher value crops	For all regions - Pests and diseases tomatoes +vegetables

MWANZA GROUP TASK 2

Theme	Activity	Approach	CP Issues	Agencies	Where	Outcome
Pest tolerant adapted varieties	1.Promotion of tolerance *Striga* resistant varieties Sorghum+ Maize 2. Multiplication of tolerant varieties	Mass Media/Large scale promotion Product delivery	Pest resistance	NGOs, MAFS,RADIO, TV	Kwimba Magu Missungwi Ilemela Nyamagana districts	Increased community awareness Increased seed demand
Low external input magt techniques	Exploring a wide range of options appropriate to semi-Arid areas. Stalk borers on maize + sorghum *Ilele* (sorghum midge)	Learning centered	Pest & diseases	Research extensionNGOs	Kwimba Magu Missungwi Ilemela Nyamagana districts	Increased product & prolong storage life.
Seed management	High demand for grain legumes Sunflower		Seed management- Quality control		Kwimba Magu Missungwi Ilemela Nyamagana districts	

SHINYANGA GROUP TASK 2

Theme	Activity	*Approach*	*Issue*	*Agency*	Where	Outcome
Pest tolerant adapted varieties	On farm seed sorghum, Maize PP, Cassava IMPART knowledge Processing utilization Marketing	Product delivery Product delivery	*Striga* Timely Planting (Husbandry practices	Farmers -Extension NGOs	All districts	Food security Income
Low external input magt techniques	- Promotion of local Fabricators of Implements (Ox-Drawn	Product delivery	QDS	Councils (L.A.) NGO CBOs Councils (L.A.) NGOs CBOs	All districts	**Labour saving** Food security Income Product reduction
Seed management	Quality control -Sorghum Maize Chick peas Groundnuts	Product Delivery	Seed Availability	TOSCA	All district	Quality seeds
IPM for higher value	Promotion of Botanicals Stalk borers		Availability of environmen	IPM-Shy L.A. (ILELE)	All district	Low production costs

crops	-Capacity Building - Sorghum		tally Friendly pesticides	Ukukungu problem		Environment preserved

Task 3 Identify future research opportunities

One mixed working groups consisting of extensionists, NGOs and researchers

- Add, modify or remove topics.
- Identify researchable areas and potential partners guided by the table

Future Research Areas for semi-arid Lake Zone

TOPIC	SOME CURRENT ISSUES	POTENTIAL PARTNERS
1.Cereals Sorghum Pearl millet Maize	-Sorghum is good for food security, but not a preferred food. Very limited market -P.millet is good for food security and a more popular food but very limited market -Maize is drought prone, but popular food and good market. -(Rice is constrained by soil type and water. Fewer CP problems)	Local Government and NGOs
2.Grain legumes: Cow pea Green gram Chick pea Pigeon pea Groundnut	Chick pea on residual moisture of mbuga soils; cowpea and green gram common, but not major crops, pigeon pea being introduced. Incidence and severity of pests and diseases not well documented Domestic market appears limited and need to further identify international market opportunities.	Vegetables oil industries
3.Vegetable Tomatoes, Onions etc Plant protection on vegetables grown for food/ cash and vegetables grown for seed	Potential impact on livelihoods of women and youth as means of income diversification. Need to clarify who is involved, needs and benefits.	CARE, KIMUKUMAKA, TAHEA, CRS and KAHEMP
4.Perennials eg Mango, Citrus Pawpaw. Others Eg Neem Wild species	Trees play multiple roles in livelihoods. Need to clarify who is involved and needs. Crop protection properties of perennial plants	
5. Agro-chemicals and alternatives 6. Knowledge and capacity building and quality control	Cotton and vegetables main user of agro-chemicals. Alternatives being promoted by various agencies.	
6. Climate change and implications for crop management	Global warming,	

APPENDIX 1 WORKSHOP PARTICIPANTS AND CONTACT DETAILS

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29	Asia K. Kapande	TAHEA	P.O. Box 11242, Mwanza Tel:028250555 0744-579289 TaheaMwanza@yahoo.com
30	Simon C. Jeremiah	ARI Ukiriguru	Box 1433 Mwanza Tel. 0744-379807 Jeremiahsato@hotmail.com
31	Engelberth P. Bujiku	ARI Ukiriguru	Box 1433 Mwanza
32	Dr. Hamis M. Saadan	Seed Unit	P. O. Box 9071 Dar-es-Salaam
33	Robert Kileo	LZARDI	Box 1433 Mwanza
34	Cornel Massawe	ARI Ilonga	P.O.Ilonga Kilosa
35	Thomas Julianus	FAO	Box 1206 Bukoba e-mail-ffskagerera@hotmail
36	Kamuntu S. Paschal	LZARDI Ukiriguru	Box 1433 Mwanza Skamuntu@hotmail.com
37	Dr. G.M.Mitawa	Ministry of Agric. & Food security	DRD Box 2066 DSM Fax 022-2865312 Tel 022-286314 drd@ud.co.tz
38	P. Kapingu	LZARDI Ukiriguru LZ.	Box 1433 Mwanza Ukiriguru@africoline.co.tz
39	D.I.M.Muganga	DALDO Bunda	Box Bunda
40	A. P. Manyerere	DALDO Serengeti	Box 162 Mugumu
41	A. L .Chibhunu	DEO Bunda	181 Bunda
42	N. Nkuromi	Ag. DEO Serengeti	162 Mugumu
43	Maganga C. J.	ARDI Ukiriguru	Box 1433 Mwanza
44	A. A. Manyama	LZARDI	Box 1433 Mwanza
45	Samuel Ibambasi	Africa Inland Church Tanzania	Box 905 Mwanza
46	J. K. Lutatina	CALDO Mwanza City	Box 1148 Mwanza
47	E.D.Lugoye	DEO Ilemela	Box 1148 Mwanza
48	R. S. Mpinzile	DEO Nyamagana	Box 1148 Mwanza
49	T. Schrader	CTA COR	Box 2807 Mwanza
50	A.P. Magere	Kilimo/Magu	P. O. Box 2 Magu
51	R. Tuni	ZRELO ARDI Ukiriguru	P. O. Box 1433 Mwanza
52	Biseko Sebastian	DALDO Magu	Box 2 Tel. 028-2530065
53	H. P. Kulembeka	ARI Ukiriguru	Box 1433 Mwanza Tel. 255-282550215 Email.kuembeka@hotmail.com
54	George	Star TV/Camera	Box 1732 Mza
55	Isaac Mbolile	Star TV Reporter	- do -
56	Andrew Manyere	DALDO-Serengeti	Box 162 Mugumu

NO.	NAME	ORGANIZATION	ADDRESS/TELEPHONE/ FAX/ E-MAIL
57	A. M. Mbwaga	ARI Ilonga	Private Bag, Kilosa E-mail :ilonga@africaonline.co.tz

Appendix 2: PARTCIPANTS AND THEIR EXPECTATIONS.

No	NAME	POSITION &ORGANIZATION	SUBJECT AREA	EXPECTATIONS
1	Robert Tuni	ZRELO	ARDI UKIRIGURU	Active participation to capture knowledge
2	Lucas J. Kullian	Ag. DALDO		Expect to learn more about *Striga* weed
3	Simon Pierce	Physiologist	University of Sheffield UK	To promote awareness of project achievements and new choices for sorghum farmers.
4	Heneriko Kulembeka	Plant Breeder	ARDI Ukiriguru	Seed multiplication strategies (knowledge) Knowledge on mechanism of resistance against *Striga*. Strategies of controlling *Striga*.
5	Charlie Riches	Agronomist	NRI UK	To share experience for *Striga* control
6	Dr. Hamis M. Saadan	Sorghum breeder	Seed unit Dar es salaam	Promotion of community seed production *Striga* and drought tolerant crops
7	Maganga C.J	From Socio-Economics	ARDI Ukiriguru	The workshop to come up with the resolutions on how to control *Striga* in the Lake Zone.
8	Joseph Hella	Agric. Economist	SUA	Farmers' views on future of sorghum & millet production in lake zone.
9	Damian M. Makaranga	Ag. DALDO Kwimba	DALDO's Office Kwimba	To learn more about *Striga* in my district.
10	Cornel Massawe	Crop protectionist	ARI Ilonga	Wider dissemination of *Striga* control options in the Lake zone
11	Nyankweli Emmanuel	Socio-scientist	SUA	Widen my understanding of research in Tanzania and other parts of the World especially CCP research.
12	Biseko Sebastian	Ag. DALDO Magu	DALDO's office Magu	To learn more on *Striga* for my district.
13	Sophia Busabusa	Ag. DEO	DALDO's office Misungwi	To get more information on *Striga* control
14	Samwel A. Ibambansi	Dev. Coordinator	Africa inland church (T) Mwanza	To get some ways of combating the big problem of *Striga*
15	Kisabo W. M	Ag. DEO	Kilimo Bariadi	Expecting to know more about *Striga* and also to know what other participants know about

No	NAME	POSITION &ORGANIZATION	SUBJECT AREA	EXPECTATIONS
				Striga.
16	Asia K. Kapande	TAHEA lake zone coordinator Food & Nutrition	TAHEA Mwanza	To gain shared experiences on the best way to control *Striga*.
17	Bakililehi Ferdinand	DALDO	Kilimo Meatu	Finding a solution to *Striga* problem in semi arid areas Addressing a food security problem by combating *Striga*.
18	Samweli Mndolwa	Scientist Sorghum and Millet	ARI Ilonga	Better distribution of sorghum resistance varieties.
19	H. Barongo	DEO	Kilimo Tarime	To share experience on *Striga* management and to come up with integrated methods for *Striga* control
20	N. Nkumburi	DPPO	Serengeti	To know different findings strategies found against *Striga*
21	Justus K. Lutatina	CALDO Mwanza City	Ilemela/ Nyamagana	To gain more knowledge on how to control *Striga*. To share experience
22	R. S. Mpinzile	DEO Nyamgana	Kilimo Nyamagana	To know many ways of how to control *Striga*.
23	Emerenciana Lugoyei	DEO Ilemela	Kilimo Ilemela	To learn how to control *Striga*.
24	Eliza Bwana	DALDO Musoma	Kilimo Musoma	Find reliable control measures of *Striga* in cereals.
25	Joshua Muro	IPM Specialists	Plant protection Depart. Lake zone Shinyanga	To know the different strategies for *Striga* management.
26	Peter Kimicho Mboya	DEO Tarime	Kilimo Tarime	To know more details on *Striga* management and its control
27	Simon S. Jeremiah	Plant protection	ARDI Ukiriguru	Exposed to various ways of controlling *Striga*
28	Robert Kileo	FS Agronomist	ARDI Ukiriguru	Informed on progress made on *Striga* research Responsibilities on dissemination of *Striga* and plant protection technologies.
29	Mukara Mugini	Ag DALDO	DALDO's office Bariadi	How quick the *Striga* can be controlled.
30	Mujuni Anatory	Majira journalist	Mwanza city	Explore what the *Striga* control program has to offer in the crop protection activities.

No	NAME	POSITION &ORGANIZATION	SUBJECT AREA	EXPECTATIONS
31	Chibhunu A. L.	DEO	Kilimo Bunda	*Striga* control measures.
32	George J. Ley	Soil scientist	ARDI Mlingano	Effective participation and extension service in planning for the future.
33	Omary H. Bori	Agronomy/Extension	DALDO Maswa	To learn more on *Striga* and new methods of *Striga* control. To understand the *Striga* management project operations and activities
34	Joseph Simbatohana	Agric. Engineer Ag. DEO Kahama	Kilimo Kahama	To learn more about the eradication of *Striga*.
35	Ephrahim E. Lema	DEO Liv/Agric Maswa	Kilimo Kahama	Exposed to new integrated methods for *Striga* control
36	Maingu Robert	Field extensionist	Kilimo Musoma	To get more knowledge about *Striga* effects on cereals and control
37	David Rwegoshora	Capacity Building	CRS Mwanza	Crop projection methods (improved)
38	Ninatubu Lema	Scientist FSR/SE	Kilimo Dar es salaam	Up-scale promotional activities on *Striga* management.
39	Deusdedit Muganga	DALDO	Kilimo Bunda	To know more in *Striga* control
40	Judicate Mwanga	Socio-economics	LPRI Mpwapwa	Sharing of information on *Striga* control
41	Mkilila M. P. L	Ag DEO Kwimba	Kilimo Kwimba	Knowledge on control of *Striga*
42	Andrew Manyerere	DALDO	Kilimo Serengeti	To learn on various *Striga* aspects
43	Julianus Thomas	Land use planning and sociology	FAO	To see more on how to improve participatory approach on technology formation and dissemination.
44	Maduhu J. P	DEO Crop production	Kilimo Meatu	Exposure to new findings on *Striga*.
45	Subira N. K	Agric. Engineer Ag. DALDO	Kilimo Kahama	To gain knowledge on *Striga* control. To make new friends.
46	Engelberth Bujiku	Zonal communication officer	ARDI Ukiriguru	To learn more on *Striga* To know the best ways of eradicating *Striga*.
47	Appolinary Manyama	Socio-economics	ARDI Ukiriguru	To come up with sustainable methods of *Striga* control
48	Kamuntu S. Paschal	Sorghum research	ARDI Ukiriguru	Strategies for *Striga* dissemination technologies

ANNEX 2

PROCEEDINGS OF CENTRAL ZONE *STRIGA* AND CROP PROTECTION SEMI-ARID REVIEW WORKSHOP

14^{TH} –15^{TH} MARCH 2003

CCT CONFERENCE HALL, DODOMA

Programme for Central Zone workshops
Day 1: Outputs of the *Striga* management project

8.30 –9.00 Registration

Chairman:Mr. Kiariro (ZRELO Central Zone)

9.00- 9.15 Opening remark
Zonal Director Central Zone
9.15 – 9.30 Workshop objectives
N. Lema DRD Secretariat
9.30 – 9.45 Aims and activities of the *Striga* management project
Dr Riches – Natural Resources Institute
9.45 – 10.00 The Striga Situation in Tanzania
Dr Mbwaga – ARI, Ilonga

10.00 –10.30 Tee/Coffee Break

Chairman: Dr. J. Hella

10.30 – 11.00 Performance and release of new Striga tolerant/resistant sorghum varieties
Dr Mbwaga – ARI, Ilonga
11.00-11.15 Option for multiplication and distribution of new varieties in the zone
Dr Saadan – MAFS Seed Unit
11.15-11.30 Cultivar diffusion patterns in Dodoma Region, Central Tanzania
Mr Mwanga – ARI Mpwapwa
11.30 – 12.00 Discussion on seed multiplication
Facilitated by R Lamboll
12.00- 12.30 Crop and soil management using resistant sorghum varieties
Dr Pierce – Sheffield University, UK; Dr Ley – ARI, Mlingano;
12.30 –13.00 Learning tools for farmer understanding of Striga biology and control
Mr Nyankweli – SUA

13.00 – 14.00 LUNCH

Chairman Dr. H. Saadan

14.00 – 14.15 Control of *Striga* in upland rice
Mr J Kayeke – SUA; Mr Mwambungu – Kyela DALDO
14.15– 15.30. Group discussion on use of decision trees, fact sheets and other learning tools
Facilitated by R Lamboll & N Lema

15.30- -16.00 Soft Drinks

Chairman Dr. A. M. Mbwaga

16.00- 16.30 Group Presentations*t*
16.30- 17.00 Reflections on Striga research and development
Dr Mitawa – DRD, Secretaria

Day 2 Review of Crop Protection Issues and Promotion Opportunities

Chairman: Mr Mwanga, ARI Mpwapwa

8:15a.m. Results of review of crop protection issues in Semi-arid Tanzania
R. Lamboll – NRI and J.Mwaga –LPRI, Mwapwa

8:45 a.m. Ilonga crop protection outputs for semi-arid areas of Central Zone
AM Mbwaga, S Mndolwa (ARI Ilonga) J Hella (SUA, Morogoro)

9.00 a,m, INADES Formation Tanzania: Crop protection related activities
J *Kitange and P Lameck; INADES Formation Tanzania, Dodoma*

9:15a.m. Overview of Crop Protection related activities undertaken by World Vision in semi-arid Central zone
Z.S. Masanyiwa (Mpuguzi ADPP)

9:30a.m. Farmer field schools (FFS) in Kondoa district
E.P. Malanga (District Extension, Kondoa)

9:45a.m. The role of the Area Development Program in Promotion of Improving Production of Appropriate Drought Resistant Food and Cash Crops in Central Zone
Rev A. Senyagwa (Diocese of Central Tanganyika Development Services Company), Dodoma)

10:00a.m. Activities of Plant Health Services in semi-arid areas of Central Zone
G D Rwabufigiri (Plant Health Services, Dodoma)

Plenary discussion

10:30a.m. Coffee/ Tea-break

11:00a.m. Group tasks on current promotion strategies

Facilitated by N. Lema and R. Lamboll

12:00noon Presentations

1:00p.m. Lunch break

2:00p.m. Group tasks on future promotion activities for the zone and research opportunities

Facilitated by N. Lema and R. Lamboll

3:00p.m. – 3:30p.m. Closure and departure

1. Welcome and opening remarks

J N W Mwanga
On behalf of the Zonal Director Central Zone Agricultural Research Institute, Mpwapwa

Delegates were welcomed to Dodoma and to the Central zone. It was pointed out that drought is a major problem facing farmers whp produce crops in Central zone. *Striga* infestation is a widespread constraint to cereal production. Collaboration of Central zone researchers with the *Striga* management project was described. It is anticipated that dissemination of the outputs of the project will bring considerable benefits to farmers in the zone.

2. Workshop themes

Mr. Ninatubu Lema.

DRD HQ, Dar es Salaam

The workshop has two major purposes. On the first day the team of the DFID funded *Striga* management project would present their findings and discuss with district extension staff and NGOs the opportunities that exist for promoting recommendations on increasing productivity of *Striga* infested fields to farmers. The second day would be devoted to a more general review of the current promotion activities being undertaken by a number of organisations in Central zone. Following a review of crop protection outputs ready for dissemination the meeting would focus on opportunities to undertake promotion work with farmers over the coming two years and then to consider topics on which further research may be needed beyond 2005. This time horizon reflects the current cycle of funds which may be available from the DFID Crop Protection Programme for the support of promotion activities in semi-arid Tanzania.

Objectives of the workshop

- Disseminate the results of the *Striga* project in Central zone
- Validate the findings of a review of crop protection constraints and opportunities in semi-arid Lake Zone.
- Explore the way forward for the promotion of crop protection research outputs
- Identify research opportunities for beyond 2005.

3. Self-introductions

Participants introduced themselves and stated their expectations of the workshop.

4. Introduction to aims and activities of the DFID CPP Management Project

Dr. C. Riches, *Striga* project leader, Natural Resources Institute UK.

See Annex 3 Paper A.

5. Status of *Striga* inTanzania.

Dr. A. Mbwaga, In-country co-ordinator, *Striga* management project

See Annex 3 Paper B.

Following this summary of the distribution of *Striga* in Tanzania and of the research activities undertaken by a number of projects implemented by DRD Dr Mbwaga answered a number of questions.

Q: What is a Rhizetron?: A demonstration tool used to show farmers how *Striga* plants attach to the roots of the host. Participants were shown one of these.

Q: By what mechanism are *Striga* seeds able to remain viable for 15 years
A: *Striga* will only germinate if root exudates from the roots of potential host plants are present.. If these plants are not growing the *Striga* seeds can go into wet dormancy and continue to another season

Q: Why are germination stimulants not used in the control *Striga* in the field?
A: They are very expensive, are not stable in all soils so they are not practical on a large scale.

6. Performance and release of new *Striga* tolerant sorghum varieties

A. M. Mbwaga, ARI, Ilonga

See Annex 3 Paper C.

Q: Among the qualities required by farmers was sorghum straw considered as animal feed after harvesting?
A: That didn't appear but after harvesting plants of the new lines remained green so would be good for animals feed.

Q: During assessment was brewing quality important?
A: Yes New varieties ranked 6 and 7 out of the 13 assessed by farmers therefore they can be considered good for brewing

Q: Why did new varieties rank low in terms of storage and quality of stiff porridge (ugali)?
A: Since the amount stored was small this response was based on a lack of information
All varieties are attacked by storage pests and there are some efforts in place to incorporate the required qualities in current breeding. Some farmers who have grown Hakika and Wahi did in fact report that it makes good ugali. The brown sorghum Weijita, brought from Mara, was rejected by farmers due to poor tasting porridge.

Comment: Many farmers decided to grow maize in Dodoma this year because the new varieties are highly attacked and they have no market. On the other hand the Maize market has improved because of draught in the neighbouring countries. An effort needs to be made to increase market demand for sorghum. On such ,market is for beer but the quality required by Chibuku breweries has not been met by farmers because of the threshing process. This could be resolved by providing farmers with market information.

7. Options for seed multiplication and distribution of new varieties in the zone

H Saadan, Seed Unit, MAFS, Dar es Salaam

Annex 3. Paper D.

Q: Are there any plans for certified seeds to be produced by farmers?
A: It is not easy to undertake seed certification at small-scale farmers' level. The government policy is to encourage the production of Quality Declared Seed. This approach to the smallholder seed problem has been pioneered in Tanzania.

Q: What are the measures to cub the problem of fake seed and the weakness of the seed distribution system in relation to QDS.
A The used of QDS will assist to solve the problem, with adequate support from a number of agencies including NGOs and there is a seed act which will be in place soon.

Q: How much faster is the rate of release of seed under QDS than seed certification? Are there funds for a 2nd phase of the project
A: The rate of release is improving following the harmonisation of East Africa seed policy. Also the establishment of breeders rights will speed and encourage the process.

In the 2nd phase the project will fund the work but with different format, concentrating on groups and large scale producers and any other interested party

8. Cultivar diffusion patterns in Dodoma Region, Central Tanzania

J N W Mwanga , LPRI Mpwapwa

Annex 3 Paper D1

Q: Was the sample was too small for assessing diffusion?
A: The requirement was to deal with farmers participating in the project.

Q: Was Lugugu variety donated or not?
A: The variety Lugugu was not donated, farmers used their own seed.

Q: Why was it planted towards the end of the project?
A: They had no seed earlier?

Q: Why were local varieties of Southern zone not used to improve varieties in the central zone?
A: Every zone has its priorities in terms of varieties and qualities.

9. Crop and soil management in the control of *Striga*.

S Pierce (University of Sheffield, UK)
G Ley (ARI Mlingano, Tanzania)

See Annex 3 Paper E

Comment: The results are consistent
Comment : The researchers used kigogo names for soils sampled. Extension staff at the meeting from other areas were not aware of these names. Even in kigogo names for the same soil vary from area to area.

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

E.M. Nyankweli and A.Z. Mattee (Sokoine University of Agriculture)
E.A. Mwageni (ARI Mpapwa)

See Annex 3 Paper F

Q: Is Rhizotron affordable in terms of price and availability
A: It is expensive from farmers point of view but for the Central government and local government the materials can be afforded for use in extension work

11. Discussions on options for seed multiplication and promotion of Hakika and Wahi

Facilitated by N.Lema and R. Lamboll.

Following the presentation by Dr Saadan, which explained three community based approaches for the production of Quality Declared Seed, discussion followed on the current situation for seed provision in Central Zone. INADES and Diocese of Central Tanganyika were identified as having been involved in seed production in the Zone. INADES described their experiences. The representative from DCT attended the second day of the workshop and discussed their experiences with seed as part of a presentation on the activities of this NGO in the zone.

INADES experience with local seed production initiatives

ORGANIZATION	INADES
PARTNERS	Italian volunteer organisation: TOSCA: ASSPS: District extension
LOCATION	Kongwa District
VARIETIES	Maize: Kilima, Staha, TMV1
QUANTITY PRODUCED	1996- 38 tones in 1 division
APPROACH	1.Farmer groups 2. Individuals 3. Schools Input from the donor – selling price in villages Tshs 650/kg (statting with foundation seed (Arusha, Msimba)
TIME	1996 todate
COVERAGE eg No of villages/farmers	6 schools and 6 farmer groups
LESSONS LEARNT	1. Farmers are used to recycling ie exchange of seed 2. form marketing groups for the seed
OBJECTIVES	Produce good quality seed close to the farmer

Other organisations listed as having experience with seed production in Central Zone are:

ICRISAT,ASPS, DASPA, JFACF (Japanese Food Aid counterpart Fund)

District Extension teams in:
Dodoma Rural – sorghum
Kondoa – Pear millet
Singida – Pigeon pea

Iramba – Ground nuts

District councils
High quality protein maize (open pollinated) has been produced in both Dodoma rural and Singida

12. Dissemination of Striga management practices

Facilitated by N.Lema and R. Lamboll

Following the presentations on the new sorghum varieties and supporting information the meeting discussed ways in which a series of training resources that are now available could be used in future extension programmes. Participants were divided into the following groups:

- Singida extension
- Dodoma extension
- Researchers

Each group was then asked to assess the crop and soil management tools and the learning tools:

1. Crop and Soil management
-Decision tree
-Variety information sheet
-Other information

2.Learning tools
-The tools

Questions considered by the groups

a. is this useful for your work
b. If yes how
c. What are the strength of each (see above)
d. What are the weakness of each
e. propose ways/means to improve this information/output

Group presentations

	Dodoma Group	**Singida Group**	**Research Group**
1. Decision Tree			
(a)Is this information useful in your work? Yes/no	Yes	Yes	Yes
(b)If yes, how would you use it	Useful in extension work as It helps to identify what variety to grow under given soil fertility status and *Striga* infestation	In promotion	Useful for different recommendation domains
c) What are the strengths?	**Helps to inform farmer decision making**	**Helps in decision making, what variety to plant depending on the presence of *Striga*, availability and type of fertilizer. There is plenty of farmyard manure available in the region and Macia seed is also available.**	Simple, offers farmers options
(d) What are the weaknesses?	**Farmers have little knowledge to interpret decision tree**	None	Generated for relatively few soils
(e) How can it be improved	Training on *Striga* biology, soil fertility management and new varieties (Hakika, Wahi) for VEOs.	None suggested	Separate decisions on use of manure or fertiliser
(f) How would you take forward?	AS above	No suggestions made	

	Dodoma Group	Singida Group	Research Group
Variety fact sheet			
(a)Is this information useful in your work?	Yes	Yes this will be helpful in promotion work aimed at ensuring food security in the Central Zone.	Yes
(b)If yes, how would you use it	Gives information on new varieties to the farmers and extension agents.	Promotion work aimed at ensuring food security in the Central Zone.	Raw material for leaflets, posters etc
c) What are the strengths?	It is informative, as it was developed from information collected from farmers and written in farmers language	Provides information on varieties which are *Striga*, drought and leaf blight resistant.	Comprehensive and gives a quick overview of the two varieties.
(d) What are the weaknesses?	Measurements used are not available at farmer level e.g. weighing machine, spacing not shown, number of seed per hill/hole and source of seed	New varieties are prone to storage pests and information on this is needed	Doesn't indicate the negative attributes of the new lines
(e) How can it be improved	None suggested	**Research programme to improve resistant to storage pests**	Include negative attributes
(f) How would you take forward?	Not suggested	Not suggested	Develop extension materials

	Dodoma Group	Singida Group	Research Group
Other information			
(a)Is this information useful in your work? Yes/no	Yes, They are informative as farmers participated in its development	Not discussed	Not discussed
(b)If yes, how would you use it	Not suggested		
c) What are the strengths?	It is informative		
(d) What are the weaknesses?	They are written in English		
(e) How can it be improved	To be translated in Swahili		
(f) How would you take forward?	Not indicated		

	Dodoma Group	Singida Group	Research Group
Learning tools			
(a)Is this information useful in your work? Yes/no	**Yes; information on tools has been developed in a participatory way**	Yes	Yes
(b)If yes, how would you use it?	Not indicated	Helps in learning process of control of *Striga*	Not indicated
c) What are the strengths?	Participatory	Tools are educational and participatory	Provides some useful information on *Striga* biology. Easily appreciated e.g. the rhizotron and some are participatory e.g. drama
(d) What are the weaknesses?	Weakness: Some tools are expensive to make or use	Some are expensive so need to look at locally available materials.	Some are expensive (Field experiments); Some are complex (Rhizotron); Some are time-consuming (Pot experiment); Some need high literacy.
(e) How can it be improved?	Innovative farmers to be involved to use local materials	Combine more than one tool in a training programme.	Investigate use of local materials to make tools
(f) How would you take forward?	No suggestions	No suggestions	No suggestions

13. Control of Striga in upland Rice

J. Kayeke (Uyole Agricultural Research and Training Centre, Mbeya)
A. Mwambungu (DALDO, Kyela)

See annex 3 Paper F1

Q: Do farmers appreciate that *Striga* is a problem?
A: Yes because it affects food and cash crops, attacks the highly preferred varieties and it has a local name (Kyumika)

14. Reflection on *Striga* research and development

Dr. Mitawa (DRD Secretariat, Dar es Salaam)

See Annex 3. Paper G

DAY 2: REVIEW OF CROP PROTECTION ISSUES AND PROMOTION OPPORTUNITIES IN CENTRAL ZONE

1. Results of review of crop protection issues in semi-arid Tanzania, in the context of sustainable livelihoods

R Lamboll (Natural Resources Institute, Uni of Greenwich) and J. Mwanga LPRI, Mpwapwa

See Annex 3. Paper H

Q: Are research themes made for proposals or just to point out areas of interest
A: There may be an opportunity for funding of promotion activities through DFID CPP before 2005

2. Ilonga crop protection outputs for semi-arid areas of Central Zone

AM Mbwaga, S Mndolwa (ARI Ilonga)
J Hella (Sokoine University of Agriculture, Morogoro)

See annex 3 Paper N

Q: Is there any work done in legumes in the central zone?
A: Yes, some work was done on cowpea to address the problem of *Alectra.* This came to an end due to a lack of funds. There has also bee work to test new lines of pigeon pea which are resistant to wilt.

3. INADES Formation Tanzania: Crop protection related activities Experiences and Issues in Central Zone

J Kitange and P Lameck (INADES formation Tanzania, Dodoma)

See Annex 3 Paper O

Q: What are the measure taken to protect farmers from some toxic plant materials they are using, and are the results validated
A: The crop protection department has been requested to carry toxicology studies and validation of the results but so far this has not been done.

Q: How far are the farmers property rights to the Indigenous technologies protected?
A: This has been discussed but it will take longer

4. Overview of Crop Protection related activities undertaken by World Vision in semi-arid Central zone

Z.S. Masanyiwa (Program Co-ordinator Mpuguzi ADPP)

See Annex 3 Paper P

Q: What is the sustainability of your project in providing agriculture inputs
A: It is a challenge to us but we are working hard to make it sustainable

Q: How do you cope with the problem of fake products in your projects

A: Again it is a challenge we are facing but we are working with researches and extension to ensure that we are getting genuine products

5. Farmer field schools (FFS) in Kondoa district

E.P. Malanga (District Extension Office, Kondoa)

See annex 3 Paper Q

6. The role of the Area Development Program in Promotion of Improving Production of Appropriate Drought Resistant Food and Cash Crops in Central Zone

Rev A. Senyagwa
Diocese of Central Tanganyika (Development Services Company)**,** Dodoma

See Annex 3 Paper R

Q: Is it a profit making company or service company?
A: It is not profit making but it charges to cover costs. Our activities are aimed at the needs of the community including to carry out seed dressing, running oil mills for thoe who need our services

7. Activities of Plant Health Services in semi-arid areas of Central Zone

G D Rwabufigiri (Plant Health Services P.O.Box.1101-Dodoma)

See Annex 3 Paper S

Q: How is the performance of the LGB biological control programme?
A: The natural enemy used so far doesn't attack the borer in grain stores

Q: Elegant grasshopper are reported by farmers to be a problem, what effort has been taken to solve this problem?
A: The pest is regarded as minor and its natural enemies are effective in containing the pest

Q: Aerial spraying is hazardous to the environment. Are there other measures to control locust and quelea birds?
A: A biological control of army worm is still under Lab work, no alternative has been put in place to control Quelea birds apart from aerial spraying

Working groups

TASK 1-Review past and current promotional activities in Central Zone

Working groups consisted of:-

- Researchers
- District extension- split into Dordoma and Singida regions
- NGOs

Each group was asked to:

- Identify 3 strengths and 3 weaknesses of the Lake Zone approach to promotion.
- Discuss and come to a common understanding of the following themes in promotion work

1. Pest, disease and weed tolerant varieties; 2. Low external-input pest management practices; 3. Seed management 4. IPM for high value crops

- According to the above themes outline activities past and current in your working areas using the format below

Theme	**Activity**	**Approach**	**Crop protection issues addressed**	**Main implementing agencies**	**Location (districts)**	**When**	**Outcomes and lessons learnt**
1.	1						
	2						
	3						

Dodoma Extension Group

Current promotion strategy

Strengths	**Weaknesses**
1. Quartely workshops 2. On-farm trials 3. Mass communication 4. Consultation prior release of research outputs 5. Study tours to the fields- ZRELO 6. Seminars in case of outbreaks e.g. Newcastle disease and funds for vaccination 7. Funding for activities from District council 8. Radio programme (Local)	1. Research findings are not delivered at the right time 2.Insufficient fund for quarterly meetings 3.Most of research are on production no marketing and processing

Theme	Activity	Approach	Crop protection issues addressed	Main implementing agent	Location /District	When	Outcomes and lessons learnt
1.Pest tolerant adapted sorghum varieties	1.On-farm trials	1.Productd elivery, Farmer group, mass media	*Striga* and smut control	Research NRI Extension Farmers	Dodoma rural	1998 to date	Hakika and wahi varieties. *Striga* control measure by manure and Crotolaria
	2.Field days	Farmer group, mass media	*Striga* and smut control	-do-	-do-	-do-	
	3.Demo plots	Farmer group	*Striga* and smut control	-do-	-do-	-do-	Information dissemination and variety selection
2.Seed management	on-farm seed production	Product delivery	Smut Stalk borer Quality control	MAFS Extension Farmers groups TOSCA	Dodoma Rural; Kondoa Kongwa Mpwapwa TOSCA	1998 to date	Seed availability At village level QDS

Singida ExtensionGroup

Current promotion strategy

Strengths	**Weaknesses**
1.On-farm Trial- sorghum inter-cropping with legumes Seed multiplication – sorghum, cassava, pearl millet FYM mixed with Minjingu rock phosphate 2.Cashew nut promotion- trials and rehabilitation 3.NCD control 4.Promotion (topics) identified by extension representing demand of the farmers	Most of research activities are done in Dodoma Region Research findings are not delivered at the right time
Use of farmers group Use of demonstration plots (Learning centred approach) Use of biological, cultural methods in pest, diseases and weed control	Lack of market for surplus especially sorghum and millet Poor storability of improved varieties (Expensive and unreliable chemicals) Limited coverage

THEME	Activity	Approach	Crop protection issues	Agencies	Location	When	Outcomes and lessons learnt
Pest tolerant adapted varieties	Seed multiplication Cashew nut trials	Product delivery Knowledge intensive	*Striga* Smut Stalk borer Powdery mildew	Research Extension Farmers Primary schools	Manyoni Singida rural and urban Iramba -do-	1996 to date 2000 to date	Draught resistant Early maturing Good taste
Low external input mngt techniques	To advice stockist to supply inputs to farmers	Learning centred	*Striga* control	Stockist Ex worker Farmers	-do-	1998 to date	Control of *Striga*
Seed management	Seed multiplication	Product delivery	Cassava mealy bug	Exworker Farmers NPA	Manyoni and Singida	2000 to date	Cassava cuttings are distributed to farmers

Research Group

Current promotion strategy

As the approach used by the Zone was not presented it was decided by the research group that it was not easy to discuss strengths and weaknesses.

Theme	Activity	Approach	Crop protection issues	Agencies	Location /District	When	Outcomes lessons learnt
Pest tolerant adapted varieties	Sorghum smut control	learning centred	Control of smut	ARI-Ilonga Dodoma rural Primary schools SUA NRI	Dodoma rural	1996 to 2002	Awareness of smut control Better Option identified
	Striga control in sorghum	learning centred	Mngnt of Striga in farmers fields using FYM and resistant varieties	ARI-Ilonga ARI-Mlingano Sheffield Univesity SUA NRI	Dodoma District	1997 to 2003	*Striga* control practices identified Resistant variety
	Soghum Pigeon pea Inter-cropping	learning centred	Possibly control of *Striga*	ARI-Ilonga ICRISAT Distrct councils	Dodoma District	2000 to date	
Seed management	Seed multiplication	Learning centred	Control of smut	ARI-Ilonga Dodoma rural Primary schools SUA NRI	Dodoma rural	1996 to 2002	Awareness of smut control Better Option identified

NGO GROUP

Strengths	Weaknesses
Use of farmers group Use of demonstration plots (Learning centred approach) Use of biological, cultural methods in pest, diseases and weed control	Lack of market for surplus especially sorghum and millet Poor storability of improved varieties (Expensive and unreliable chemicals) Limited coverage

Theme	Activity	Approach	Crop protection issues	Agencies	Location District	When	Outcomes and lessons
Pest tolerant adapted varieties	Training Demonstrations Study tours Provision of inputs	Product delivery learning centred Mass media	Smut Armyworms Aphids	DCT/DSCC World vision	Dodoma rural Dodoma urban Kondoa Mpwapwa Iramba	1997 to date DSCC 1991 Todate	

TASK 2 Future Promotion opportunities

Singida extension group

Theme	**Activity**	**Approach**	**Crop production issues**	**Agencies**	**Location**	**Anticipated outcomes**
Pest tolerant adapted varieties	On-farm trials To control Powdery mildew Introduction of resistant varieties	Learning centred (participatory) Product delivery	Powdery mildew in cashew nut -do-	Research Extension Farmers Cashew nut board Primary schools	All districts in Singida	High yields Tolerant varieties to powdery mildew Increased farmers intake
	To conduct trial on cassava mosaic	Learning centred (participatory) Product delivery	Cassava mosaic	Researcher Extension Farmers Primary schools NPA	All districts in Singida	Cassava mosaic tolerant varieties
Seed management	To produce QDS Sorghum (Macia) Wahi, Hakika. Pearl millet (okoa)	Learning centred Product delivery	Seed dressing On-farm seed selectio	Researchers Farmers TOSCA Extension workers Msimba seed farm	All districts in Singida	Clean seed against smut
IPM for higher value crops	To conduct trial on blast control on onion	Learning centred Product delivery	Blast control on onion	Researchers Tengeru Farmers Extension workers	All districts in Singida	Blast tolerant varieties

Dodoma extension group

Theme	Activity	Approach	Crop production issues	Agencies	Location	Anticipated outcomes
Variety promotion	On-farm seed multiplication Sorghum varieties resistance to *Striga* Smut control in sorghum FFS in sorghum	Learning centred Learning centred Learning centred	Control of Striga weed Control of smut Practices for *Striga* and smut	Research Extension Farmers Councils MAFS NGOs	All districts of Dodoma	Adequate resistant seed of sorghum Awareness of smut problem and chemicals Majority of farmers will adopt the knowledge crop mngt on smut, *striga*, stem borers and other diseases
	Validation & identification of IK on sorghum, maize, millet, cowpea, pp. cassava,HC	Learning centred Learning centred	control of pests (stalk borer and storage) and diseases	Research Extension Farmers Councils MAFS NGOs	All districts of Dodoma	Documented IK practices and methods at village levels Awareness of IK
Seed	On-farm seed	Learning	resistant to	TOSCA	All	QDS

managem ent	multiplication of sorghum, maize, millet, pigeon pea, cow peas, Horticultural crops, cassava, sweet potatoes	centred	*Striga* Fusarium wilt, weevils, fungal diseases	Private sector	districts of Dodoma	Clean planting materials for cassava
	Market promotion for above crops	Learning centred	Storage packaging	TOSCA Private sector	All districts of Dodoma	Streamline marketing
	FFS, Cereal crops, Hort crops, cashew nut, grapes	Learning centred	Control of pests and diseases	MAFS, NGOs Councils	All districts Dodoma	High quality and mark table products

Varieties: sorghum- Hakika, Wahi, Pato, Okoa, Shibe
Pigeon pea- MALT 2002
Cow peas- Fahari, Vuli, Tumaini
Cassava- Mumba
Sweet potato- Simama, Sinia
Saize- Staha, TMVI

TASK 3 Future Research Areas

SINGIDA GROUP

	Researchable areas	Potential partners
Cereals: Sorghum, maize, Pearl millet	Diseases in sorghum leaf blight Pests: Storage pests, larger grain borer (maize, sorghum and Pearl millet) Utilisation of sorghum Commercialisation of sorghum and pearl millet	ICRISAT, ARI-Ilonga, MAFS, TAHEA, ARI-Hombolo and Private sector
Grain legumes: Chick pea	Agronomic package, spacing, seed rate and post-harvest studies	ICRISAT, ARI-Ilonga, MAFS, Private sector
Vegetables: Tomatoes Onions	Resistant varieties against late and early blight Resistant varieties against leaf blast	ARI-Tengeru
Perennials	Variety development: Mango, Pawpaw	ARI-Tengeru
Agro-chemicals	IPM on Cotton	DRD, ARI-Ukiriguru, Private sector and NGOs

Dodoma group

	Researchable areas	Potential partners
Cereals: Sorghum and Pearl millet Maize	Breeding palatable varieties by participatory to ensure consumer preference Processing and utilization Storage techniques Marketing and social change Early maturing varieties Better storability High protein maize	Researchers, Extension, MAFS, farmers, NGOs, Stockists and Private sector
Grain legumes: Cowpeas, Greengrams, Pigeon pea, Chick pea Ground nuts	Breeding for Consumers preference Early maturing Pest tolerant Breeding for high oil content Storage practises to avoid fungi Processing and marketing	Researchers, Extension, MAFS, farmers, NGOs, Stockists and Private sector
Vegetables: Tomatoes Onions	Processing and marketing, storability and validation	Researchers, Extension, MAFS, farmers, NGOs, Stockists and Private sector
Perennials Pawpaw, Grapes, mangoes, Moringa, Neem, Sweet paper (Paprica)	Market survey, validation of technology, Baseline survey, Documentation, Wine processing	Researchers, Extension, MAFS, farmers, NGOs, Stockists and Private sector

Climate	Rain water harvesting, Environment (tree planting)	Researchers, Extension, MAFS, farmers, NGOs, Stockists and Private sector
Agro-chemicals	IPM, Capacity building, Quality control of agrochemical	Researchers

Mixed Group of research, extension and NGOs

	Researchable areas	**Potential partners**
Cereals	-Post-harvesting technologies on sorghum to improve threshing -Utilisation of Sorghum -Storage of maize and sorghum -Draught tolerant varieties of maize e.g. Staha -Up-scaling of rain water harvest technologies	SIDO,SUA, NARS, NGOs, CBOs, District Councils, Farmers , NRI, Funding agencies.
Grain legumes	Studies on yield losses caused by *Alectra* in cowpeas Screen for tolerance to field insect pests in pigeonpea marketing research on groundnuts and cowpea Varieties, oil content and CP	Not indicated
Vegetables	Post harvest processing to increase shelf life Studies on better packaging e.g. tomatoes	
Perennials	Testing varieties for adaptation e.g. mangoes	
Agro-chemicals and alternatives	Validation of available Indigenous Knowledge	
Global warming	Natural Resource management and Rain Water Harvesting	

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Participants Disciplines and expectations of the meeting

No	NAME	DISCIPLINE/ RANK	EXPECTATIONS
1	Juma Kayeke	Agronomist	Sharing research information and experiences with other participants
2	A.N.A Mwambungu	DALDO, Kyela	To share experience
3	G.J.Ley	Soil scientist	Effective participation of extension staff in planning for the future
4	S.I. Mndolwa	Breeder	Sustainable production and seed distribution of Wahi and Hakika
5	Cornel Massawe		
6	N.M. Lema	Agronomist	Identify research outputs and promotional activities
7.	S. Pierce	Plant physiologist	To promote output of Striga project

No	NAME	DISCIPLINE/ RANK	EXPECTATIONS
8	C. Riches	Agronomist	Share experiences on Striga control
9	Nyankweli, Emanuel	Social Scientist	Learn more about research in Central Zone and Tanzania
10	N.E. Kiariro		
11	D.L. Nonga	DEO, Singida	To know what is the current solution to Striga problem
12	Job D. Mika	Extension	Fruitful discussion on crop protection in general
13	Richard Lamboll	Social economist	To identify opportunities for promotion of C.P. Research outputs
14	Sebastisn Kandira	Extension, Dodoma	Farmers know the economic loss of *Striga*
15	Richmond Urasa	DALDO, Mpwapwa	To understand the best way to control *Striga* in Central zone
16	S.R. Mangapi	DEO, Mpwapwa	To know more on *Striga* weed
17	C.I. Kanuya	DEO, Dodoma urban	To know proper management of Striga
18	R.M. Tarimo	DALDO, Manyoni	To know about *Striga* in the Central zone
19	C.A. Karigo	DALDO, Singida	To get a wider knowledge on Striga
20	E.C. Kyenga	DEO, Manyoni	To know more about *Striga* weed in Central zone and the control measure
21	E.P. Malonga	DEO, Kondoa	Gain Knowledge on Striga management
22	F.P.M. Kasanga	DALDO, Kongwa	Control of Striga
23	Benny K. Nyanda	DEO, Kongwa	To learn more about Striga and soil fertility on sorghum production
24	Elias A Letayo	Agronomist	What is known to researcher should be extended to farmers and sharing experience together
27	Judicate Mwanga	Social Economist	Sharing information
28	Patric Lameck	Agric. Engineer	Come up with viable strategies to wipe out Striga in Tanzania
29	Emil Pallangyo	Extension	To come up with sustainable *Striga* management strategies in the farmers fields
30	Mayenga M.M. Mohamed	Extension Dodoma	The workshop will come up with appropriate *Striga* control strategies in semi-arid areas
31	John V. Semwaiko	Extension, Dodoma	To know more about Striga
32	Mary Bonaventure	DEO, Dodoma rural	How majority of farmer may learn more on Striga management in relation to crop production
33	Thomas Mwachambi	DALDO, Dodoma	to come up with resolution which will enable proper dissemination of knowledge achieved in *Striga*

No	NAME	DISCIPLINE/ RANK	EXPECTATIONS
			control
34	Boniface Tibaijuka	DALDO, Dodoma urban	To identify the better and economical way of controlling *Striga* at farm level
35	Joseph Hella	Social economist	Share experience on you and I know
36	G. Rwabufigiri		
37	A.M. Mbwaga	Pathologist	we come up with a clear promotion uptake pathway
38	B.N. Chande	Extension	To learn more about *Striga* and to know new varieties which are *Striga* resistant
39	Z.S. Masanyiwa	World Vision Tanzania	
40	Rev. A.H. Senyagwa	DCT/DSC	
42	Dr. G.M. Mitawa	DRD/MAFS	
43	Dr. H Saadan	Seed Unit	
44	Mchomvu Abisa	Photographer	
45	Damian Kanuti	ITV	Press
46	Zeno Lukoa	RTD	Press
47	Mary Edward	ITV	Press

ANNEX 3

WORKSHOP PAPERS

Paper A
Introduction to aims and activities of the *Striga* Management Project 1999 to 2003

C. R. Riches
Natural Resources Institute, University of Greenwich, UK

Background and project objectives: *Striga* species, the so-called witchweeds, are widespread on the fields of small holder farmers in semi-arid areas of Eastern and Southern Africa, including in Tanzania. These noxious parasitic weeds principally attack and reduce the yield of finger millet, maize, sorghum and upland rice in these regions. In many areas it is the crops of resource-poor households that are affected by these weeds. They impose an additional stress with which people, who have little capacity for investment in crop production, have to cope in an environment characterised by marginal rainfall for cropping and declining soil fertility. Since 1996, with financial support from the UK DFID Crop Protection Programme, staff from the Department of Agricultural Research, and Sokoine University in Tanzania and, Natural Resources Institute and University of Sheffield in UK have been collaborating in studies aimed at developing integrated *Striga* management practices. The main objectives of the project have been to validation and promote strategies which will enable farmers to increase the productivity of sorghum, maize and upland rice on *Striga* infested soils. Studies have being undertaken on-station and on infested farmers' fields in affected communities in the Central, Eastern, Lake and Southern Highlands agricultural zones in Tanzania, with laboratory studies at the University of Sheffield. On-farm studies have been implemented in collaboration with District Agricultural Extension staff.

Project partnerships: Field studies in Tanzania have been co-ordinated by Ilonga Agricultural Research Institute, under the leadership of Dr A M Mbwaga. In the Lake Zone field trials were conducted at Ukiriguru and in two villages in Misungwi District under supervision of LZARDI staff working in partnership with the district Extension Team. Central Zone research staff undertook on-station trials at Hombolo while work in three villages was implemented with district level and village extension officers from Dodoma Urban and Dodoma Rural districts. Field trials focused on the validation of sorghum tolerant lines on a range of soil types. Mlingano Agricultural Research Institute has provided support for soil analysis. An important on-going activity undertaken at Ilonga has been the multiplication of sorghum lines to ensure that there has been sufficient seed for the extensive on-farm trials programme. Specialist, back-up studies have been undertaken in the glass houses and laboratories at Sheffield University, UK. A number of techniques have been used to determine the durability of *Striga* tolerance in sorghum lines under levels of soil fertility typical of those found on farmers-fields in Lake and Central zones. Natural Resources Institute, UK, and Sokoine University have provided support for agronomic and social science aspects of the project programme. The project has provided research opportunities for two Masters and one PhD student from SUA. Ilonga ARI and Sheffield University have also undertaken studies to identify sources of tolerance to *Striga* in maize. Field trials on maize were planted in Muheza district with follow-up laboratory studies in Sheffield. Work has also been undertaken with extension staff and farmer groups in two villages in Kyela District, Southern Highlands zone. Here the focus has been on evaluating practices for the management of *Striga* in upland rice.

Phase 1 of the project: This was implemented between 1996 and 1999. There was particular emphasis on establishing farmer research groups and working with these to develop and understanding of the extent of the problem and farmers knowledge of *Striga* and possible control options. There were three main outputs:

- An understanding of the importance of and farmers perceptions of *Striga* in sorghum, maize, rice and finger millet based farming systems
- A clearer understanding of the association of *Striga* with declining soil fertility. The project has focused on *Striga* as an indicator of poor soil fertility rather than simply a pest to be controlled. This has led to the need to think of *Striga* as a system issue and control from the viewpoint of integrated crop management.
- On-station and on-farm selection of *Striga* tolerant sorghum cultivars was undertaken in Lake Zone (*S. hermonthica* and *S. asiatica* infested sites) in Central (*S. asiatica*) and at Melela in Eastern zone at a site infested by *S. forbesii*.

At the end of phase 1 a stakeholders meeting was held in Dar es Salaam in September 1999. The results from the previous three years were presented and national crop and zonal priorities were agreed for a follow-on project. This was started in March 2000 and is due to end in March 2003. The workshop agreed the following zonal priorities:

- Sorghum in Central and Lake Zone
- Maize in Eastern Zone (particularly Tanga) but also an issue in Central and Lake Zones.
- Upland rice in Southern Highlands (particularly Kyela) but also in parts of Eastern and Southern zones.
- Finger millet generally a low priority (except on a local scale in Serengeti) so no further work was planned.

Activities 2000-2003: Phase II of the project continued to take a farmer centered approach with the majority of activities implemented through farmer research groups in the villages where phase 1 studies had been undertaken. Studies were planned to address the following outputs:

Sorghum

- Farmer assessment of *Striga* tolerant sorghum varieties in on-farm trials in Central and Lake Zones
- Registration and release of at least one tolerant variety
- Multiplication of breeders seed of at least one tolerant variety and distribution of seed to selected seed multiplication sites
- Development of practical guidelines for research and extension on how to target the use of available sorghum varieties based on a knowledge of soil fertility and the *Striga* tolerance or susceptibility of each variety
- Validation of integrated management options for production of *Striga* tolerant sorghum varieties by farmers
- Guidelines on approaches which facilitate farmer and other stakeholder understanding of *Striga* and *Striga* management options

Maize

- Identification of *Striga* tolerant maize varieties based upon known traits
- Candidate *Striga* tolerant maize varieties selected for future testing by Zonal programmes

Upland Rice

- *Striga* management options for upland rice

The Status of *Striga* research in Tanzania

A.M. Mbwaga
Ilonga Agricultural Research Institute

Species and distribution: With the exception of Arusha, Kagera, Kigoma, parts of Iringa and Rukwa most districts of the country have been surveyed for the occurrence of parasitic weeds through a number of projects. *Striga asiatica* is found through out most of the country on maize, and sorghum and on finger millet in Serengetti and on and upland rice in Kyela (Mbeya) and Matambo (Morogoro Rural). *S. forbesii* is a serious problem on maize, sorghum and finger millet in Mara, Mwanza and Shinyanga regions. A third species, *S. forbesii*, is found on heavier more moisture retentive soils parasitic on sorghum and maize in parts of Morogoro, coast and in Kyela. Other parasic weeds of importance to small holders are the yellow flowered *Alectra vogelii*, a problem on cowpeas and the rice pest *Ramphicarpa fistulosa* which is a local problem in the lowlands of Kyela.

The importance of the problem is reflected in the many local names for *Striga* used by farmers as shown in the following table:

Local name	**Tribe**	**Local name**	**Tribe**
Kiduha	Sukuma, Nyamwezi, Jita, (Mara, Mwanza, Shinyanga)	Ebitoha	Zzanaki, Kuria, Ngoreme (Mara)
Ilambito, Mahanga, Mhiriri, Kiduhi	Gogo (Dodoma)	Sani	Luguru, Kaguru (Morogoro)
Kishani	Zigua (Tanga)	Motomoto	Bondei (Tanga)
Chiluri	Rangi (Singida)	Kasimba	Fipa (Rukwa)
Chihavi, Kafwiti	Ngoni (Ruvuma)	Chilori	Burunge (Kondoa)
Chiluba	Mwere (Mtwara/Lindi)	Senegee	Sandawi (Kondoa)
Lindimu, Nanchilanga	Makonde (Mtwara, Lindi)	Chinkungulu	Makua and Yao (Mtwara, Lindi)
Chiavi	Makua and Yao (Mtwara, Lindi)	Kyumika	Nyakyusa (Mbeya)
Kalozi	Bungu (Mbeya)	Ukankala	Nyiha (Mbeya)

During survey work to define the extent of the problem information was collected on the extent of the problem, farmer awareness of the problem, current control meaasures, possible reasons for an increase in the problem and knowledge of extension staff of *Striga.*

Reasons for the increase in the *Striga* problem in Tanzania:

- Continuous cereal mono-culture
- Decline in soil fertility
- Limited crop rotation
- Re-cycling of crop seed harvested from *Striga* infested fields
- Movement of cattle from *Striga* infested to *Striga* free areas

***Striga* research activities at Ilonga:** Research has been undertaken with the support of a number of donors within the following activities.

- Screening germplasm for *Striga* resistance. This has been undertaken in the screen house and at *Striga* infested hotspots in the field. Main sites for this work have been Tanga (maize and *S. asiatica);* Ukiriguru (sorghum and *S. hermonthica*), Hombolo (Sorghum and *S. asiatica*) and, Melela (maize, sorghum and *S. forbesii/S. asiatica*). Materials screened have included cultivars and breeding lines from SADCC/ICRISAT and from FAO regional programmes.
- Developing and evaluating *Striga* control options. Research has been undertaken on cereal/legume inter-crops, manipulation of planting dates, use of fertiliser and post-emergence application of the herbicide 2,4-D.

Training: A range of training materials have bee produced for extension staff and farmers. This has included publication of a video describing the extent of the problem, training manual for extension as well as posters, leaflets and a brochure in Swaheli.

The biology of *Striga* differs considerably to that of non-parasitic weeds and much work has been done to raise awareness of the parasite in Tanzania. Training of extension staff and farmers has emphasised the following points:

- The main damage to the host occurs before *Striga* emergence;
- *Striga* seeds remain viable for 15-20 years in the absence of a host;
- *Striga* plants produce a high number of seeds – up to 70,000 per plant;
- To prevent seed production, weeding needs to be done later than for other weeds but before *Striga* flowers. Weeded *Striga* plants must be taken from the field and burnt to prevent further infestation of the field.

Performance and release of new *Striga* tolerant/resistant sorghum varieties

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Background: **One of the major components of the *Striga* project management has been to evaluate *Striga* tolerant or resistant sorghum lines. Studies were undertaken on-station and, on infested farmers fields in the Central, Eastern and Lake Zones. Out of this study two sorghum varieties have been approved and released by the Tanzania National Seed release Committee. Both cultivars were developed at Purdue University in the USA. Sorghum cultivar P9405 has been registered with the name Hakika ("sure of getting a crop") while P9406 has been named Wahi ("early"). Both varieties show good resistance against *S. asiatica, S. hermonthica* and *S. forbesii* the most economic important Striga species in the country. In addition they are early maturing, drought tolerant, good grain quality and good taste as evaluated by participating farmers.**

Methodology: Sorghum lines P9405 and P9406 (obtained from Purdue University in the USA), SRN 39 (from Sudan), commercially released cultivars Pato, Macia and local sorghum land race Weijita (from Mara North West of Tanzania) were evaluated for *Striga* resistance at *S. hermonthica, S. asiatica and S. forbesii* hot spots. Some of the sites were infested by two parasite species. The same materials were also evaluated on farmer's fields for *Striga* resistance, yield and farmers acceptance. Locations for on-station testing were Melela in Morogoro rural, a hot spot for *S. asiatica* and *S. forbesii*, Hombolo in Central Zone for *S. asiatica* and Ukiriguru in the Lake zone where the major problem is *S. hermonthica.* The entries were planted in plots of four rows replicated three times. Striga counts were from two center rows at 9^{th} and 12^{th} week after planting (WAP) and at harvest. Sorghum grain yield was assessed from the two center rows

The on-farm evaluation was conducted at three villages in Dodoma rural (Mvumi Makulu, Mpalanga and Chipanga) and two villages in Misungwi (Mwagalla and Iteja) districts. From each village at least five farmers participated in the trials. On-farm plot sizes were 5 m by 10 m with farm sites used as a replicate. Striga counts and sorghum grain yields were determined from the five middle rows at 12^{th} week after planting (WAP). Group discussion and matrix ranking was undertaken to determine farmer preferences and acceptability of the new materials.

Results: The evaluations were undertaken over a three year period and typical results are shown for replicated field trials in Tables 1-7. It was consistently observed that lines P9405 and P9406 supported lower numbers of emerged *S. asiatica, S. forbesii* and *S. hernonthica* than other lines, particularly the released cultivar Pato. The "P" lines also tended to be more productive, producing higher yield than Pato and Macia at heavily infested sites. Pato and Macia on the other hand have a higher yield potential and perform well under *Strga* free conditions, as was observed at Ilonga (Table 7). These observations were confirmed under farmer management across a range of soil types in villages in both the Lake and Central Zones (Tables 8-14). Farmers ranked the sorghums under test on their fields over two seasons according to their own criteria. Examples of these perceptions are shown in Tables 16 and 17. P9405 and P9406 ranked highly for a number of important traits including drought and *Striga* tolerance, early maturity and yield. Infestation levels of a number of diseases were also recorded. P9405, P9405 and Macia are not susceptible to leaf blight that was a particular problem on Pato at a number of locations in 2002. P9406 is

somewhat more susceptible than other lines to long smut so it would be better to plant P9405 at on *Striga* infested fields in areas where long smut is common.

Conclusion: Many farmers have adopted Pato due to its high yielding and relatively early maturity. However under conditions of drought, *Striga* and foliar disease, the productive potential of Pato is not realised. In such situations P9405 and P9406 offer alternative options and have been ranked by farmers as early maturing, Striga and drought resistant. Some local cultivars, although highly palatable, are late maturing and low yielding. Farmer assessment indicates that P9405 and P9406 are palatable and have a potential to be marketed. As a result of this work the findings were presented to the Tanzania Official Seed Certification Agency who agreed to the registration and release of P9405 as the cultivar "Hakika" (meaning to be sure) and P9406 as Wahi (meaning early). Foundation seed is now under multiplication. The main characteristics of each cultivar are summarised in the attached fact sheet "

Table 1: Evaluation of advanced sorghum lines for *Striga* resistance and sorghum grain yield, Melela Morogoro 2000

Sorghum Entries	*Striga* numbers/7.5 m^2				**Yield** (t/ha)
	9 WAP		12 WAP		
	S. forbesii	*S. asiatica*	*S. forbesii*	*S. asiatica*	
P9405	0.8	1.0	3.5	21.3	1.7
P9406	0.0	0.5	8.0	16.8	2.0
SRN 39	3.3	7.0	55.5	114.0	1.6
Weijita	0.5	4.0	29.5	117.3	1.6
Pato	0.3	10.5	17.5	190.0	1.2
Macia	0.8	11.5	29.8	216.8	1.1
Mean	0.92	5.75	23.96	112.67	1.53
SE	0.40	1.58	5.90	28.28	0.09

Table 2: Evaluation of advanced sorghum lines for *S. asiatica* resistance and grain yield, Hombolo, 2000:

Sorghum Entries	**Striga Numbers/7.5m^2**			**50 % flowering**	**Plant height (cm)**	**Yield kg/ha**
	9WAP	**12WAP**	**harvest**			
P9405	7.0	42.3	99.5	69	97	1013.3
P9406	8.8	78.0	127.0	71	83	566.7
SRN 39	15.0	156.5	235.0	69	108	340.0
Weijita	4.8	56.0	98.5	70	182	420.0
Pato	8.8	125.5	161.8	71	116	526.7
Macia	7.8	104.5	149.5	70	95	846.7
G.Mean	8.83	93.79	145.21	70	107.3	618.93

SE	1.89	16.08	18.18	0.21	6.50	108.40

Table 3: Evaluation of sorghum cultivars for *S. asiatica* resistance, Hombolo 2002

Sorghum entries	Plant stand	STRIGA COUNT			Plant height(cm)	Yield (t/ha)
		9WAP	12WAP	At harvest		
P9405	78	17	18	25	106	2.0
P9406	90	14	23	41	95	1.6
SRN 39	90	38	150	169	141	0.8
Weijita	93	23	125	141	171	0.7
Pato	88	28	93	105	137	0.9
Macia	90	12	58	71	108	1.1
Mean	88.4	22.0	77.8	92.0	126.3	1.20
S.E.	2.7	3.6	14.8	15.2	5.9	0.15

Table 4: Evaluation of advanced sorghum lines for Striga resistance and grain yield, Ukiriguru 2000

Sorghum Entries	Striga numbers/7.5m^2						Yield *Kg/ha*
	S. herm. 9WAP	*S. asia* 9WAP	S. herm. 12WAP	*S. asia* 12WAP	S. herm. harvest	*S. asia* harvest	
P9405	12.8	0.8	32.0	13.8	42.8	26.8	783
P9406	2.3	0.0	11.5	21.3	9.8	27.0	583
SRN 39	4.8	0.0	59.0	7.5	77.5	9.8	87
Weijita	7.8	0.0	74.8	8.3	122.0	8.3	60
Pato	5.5	0.0	40.0	15.5	62.3	14.3	233
Macia	9.0	0.0	45.5	3.5	60.0	6.3	283
Mean	7.00	0.21	43.79	11.63	62.38	15.38	338.3
S.E.	1.09	0.15	6.44	3.54	11.11	5.17	58.65

NB S. herm. = *Striga hermonthica S. asia = S. asiatica*

The season was poor with terminal drought; heavy infestation by midge resulted in low sorghum grain yields

Table 5: Evaluation of sorghum cultivars for *S. hermonthica* resistance, Ukiriguru, 2002

Sorghum entries	Plant stand	STRIGA COUNT			Days to 50% flower	Leaf blight score(1-5)	Yield (kg/ha)
		9WAP	12WAP	At harvest			
P9405	76	0.0	4.7	47.3	67	1.0	933
P9406	72	1.0	5.5	14.0	66	1.0	943
SRN 39	66	0.0	7.3	48.0	80	1.3	890
Weijita	72	0.3	2.3	19.5	83	1.3	953
Pato	67	0.0	3.5	9.0	84	1.5	823
Macia	69	0.8	8.3	35.0	75	1.0	963
G. Mean	70.0	0.35	5.26	28.45	76.2	1.17	917
S.E.	1.3	0.18	1.09	7.60	1.8	0.08	55.3

Table 6: Evaluation of advanced sorghum lines for grain yield, on a *Striga* free field plot, Ilonga 2000

Sorghum Entries	Stand count	50% flowering	Plant height (cm)	Number of lodged plants	Agronomic score (1-5)	Grain yield (t/ha)
P9405	57	58	105	0	2.1	2.3
P9406	61	58	107	0	3.1	1.8*
SRN 39	53	62	131	3	2.6	2.2
Weijita	63	65	204	1	3.4	3.3
Pato	56	63	151	1	3.0	3.2
Macia	49	62	104	3	2.9	2.1
G.Mean	56.3	61.5	133.5	1.8	2.84	2.46
SE	1.7	0.6	7.8	0.4	0.12	0.14

*Damage by American boll-worm at grain filling

Table 7: Evaluation of sorghum genotypes for *S. asiatica* resistance and grain yield, Mpalanga 2001

Entry Name	Plant stand count	*Striga* count/25m^2		Yield (t/ha)
		12 WAP	At harvest	
P9405	200	10.0a	72.8a	1.4c
P9406	190	286.4a	500.5ab	1.1b
SRN 39	171	275.6a	473.6ab	1.2bc
MACIA	181	134.1a	578.4b	1.1b
PATO	184	648.2b	1533.8d	0.6a
G.Mean	2185.6	270.85	631.83	1.05
SE	6.2	51.39	93.85	0.05

Table 8: On-farm evaluation of promising sorghum genotypes for *S*. asiatica resistance and grain yield, Chipanga 2001

Entry Name	**Stand count/ 25m2**	***Striga* count/25m^2**		**Long smut 25 m^2**	**Yield t/ha**
		12 WAP	*At harvest*		
P9405	189	0.0	0.0	1.5a	1.6
P9406	191	0.0	0.0	14.4c	1.0
SRN 39	230	0.0	0.8	4.3ab	1.6
Macia	226	0.0	16.0	10.9bc	1.4
Pato	185	46.3	99.7	11.8bc	1.5
Mean	204.3	9.27	23.28	8.57	1.42
S.E.	8.4	7.99	15.30	1.41	0.11

Table 9: On-farm evaluation of promising sorghum genotypes for *Striga* resistance and grain yield, Chipanga 2001

Entry Name	**Stand count/ 25 m2**	***Striga asiatica* count/25m^2**		**Yield t/ha**
		12 WAP	**At harvest**	
P9405	115	1.6a	4.4a	1.0
P9406	117	2.3a	4.6a	0.9
Pato	127	55.8b	109.8b	0.7
Mean	120.4	19.89	39.61	0.87
S.E.	5.5	7.5	12.31	0.07

Table 10: On-farm evaluation of promising sorghum genotypes for Striga resistance and grain yield, Mwagalla 2001

Entry Name	**Stand count/ 25 m^2**	***S. hermonthica* count/25m^2**		**Yield kg/ha**
		12WAP	**At harvest**	
P9405	38	11.5	18.2	252
P9406	38	11.2	13.8	372
SRN 39	27	21.8	40.9	228
Weijita	27	29.0	47.1	452
Macia	25	9.6	7.5	239
Pato	39	29.1	40.8	350
Mwa'ndungu	10	14.2	20.0	600
Mean	31.9	18.3	27.29	321.0
S.E.	2.1	3.5	4.59	0.04

Table 11: On-farm evaluation of promising sorghum genotypes for *S. asiatica* resistance and grain yield, on Isang'a Chitope soils, Mvumi 2002

Entry Name	Plant count/25m2	STRIGA COUNT/25m2		Yield t/ha
		12WAP	At harvest	
P9405	116	18.0	143.7	2.0b
P9406	125	13.7	20.5	1.4ab
Macia	128	265.3	276.8	1.1ab
Pato	134	301.0	776.8	0.8a
G.Mean	125.6	149.50	304.46	1.31
S.E.	11.4	68.41	163.88	0.96

Table 12: On-farm evaluation of promising sorghum genotypes for *S. asiatica* resistance and grain yield, on Ngongomba soils, Chipanga village - 2002:

Entry Name	**Plant count/25m^2**	*STRIGA COUNT/25m2*			**Yield t/ha**
		9WAP	*12WAP*	**Harvest**	
P9405	98	0	0	0	1.0
P9406	104	0	0	0	1.4
Macia	111	0	0	0	1.6
Pato	88	0	0	1.4	1.4
G.Mean	100.3	0	0	1.03	1.34
S.E.	6.0	0	-	-	0.16

Table 13: On-farm evaluation of promising sorghum genotypes for *S. hermonthica* resistance and grain yield, at Luseni soils, Iteja 2002:

Entry Name	**Plant count/25m^2**	**STRIGA COUNT/25m2**			**Yield t/ha**
		9WAP	**12WAP**	**Harvest**	
P9405	44	3.8	11.2	14.2	1.2
P9406	43	6.2	18.6	24.4	1.2
Macia	42	5.8	15.0	19.8	0.8
Pato	45	9.4	45.4	89.8	1.1
G.Mean	43.4	6.30	22.55	37.05	1.06
S.E.	3.4	1.52	6.43	15.54	0.12

Table 14: On-farm evaluation of sorghum genotypes for *S. hermonthica* resistance and grain yield, Mwagalla 2002

Entry Name	**Plant stand count**	**STRIGA COUNT/25m^2**			**Yield kg/ha**
		9WAP	**12WAP**	**At harvest**	
Pato	128	35.8	196.0b	192.0b	337
P9406	100	5.2	16.7a	27.3a	783
P9405	97	11.5	36.8ab	56.8a	603
Macia	73	5.3	69.7ab	69.8a	437
G. Mean	99.6	14.46	79.79	86.50	540.0
S.E.	10.8	5.27	29.94	23.19	124.0

Table 15: Disease score (scale 1-5) from sorghum cultivars tested on farm Dodoma rural 2002:

Sorghum entries	Leaf blight	Sooty stripe	Long smut
P9405	**1.5**	**1.4**	**1.4**
P9406	**1.5**	**1.3**	**1.8**
Macia	1.5	1.6	1.5
Pato	**3.0**	**1.0**	**1.6**
G.Mean	**1.83**	**1.31**	**1.57**
S.E.	**0.12**	**0.07**	**0.14**

Table 16: Sorghum variety preference by farmers criteria: men and women in Mvumi Makulu village Dodoma rural:

	Criteria	Tege meo	Mhuputa	Sandala	Pato	Lugugu	**P9406**	**P9405**	Bangala	Lugugu Arusha
1	High yielding	4	8	5	**1**	9	**2**	**3**	7	6
2	Ability to withstand drought	4	7	5	**3**	9	**1**	**1**	8	6
3	Ability to withstand Striga	4	9	5	**3**	8	**2**	**1**	7	6
4	Shortness of plants	3	7	5	4	9	**2**	**1**	8	6
5	Ease of marketing	9	6	3	**5**	1	6	5	4	2
6	Resistance to birds	6	-	5	7	2	8	9	1	4
7	Not easily attacked by field pests	6	3	5	9	1	7	8	3	4
8	Not shattering	4	2	5	3	8	2	1	7	6
9	Resistance to storage pests	9	9	6	5	1	7	8	4	3
10	Good tasting of ugali	9	2	7	8	1	6	5	4	2
	Total	58	56	51	48	49	43	42	53	45
	Ranking according to criteria	**9**	**8**	**6**	**4**	**5**	**2**	**1**	**3**	**7**

Table 17: Sorghum variety ranking by farmers criteria: Women in Iteja village Missungwi district.

No.	Criteria	Pato	Weijita	**P9406**	**P9405**	Macia	SRN 39	Mwnangund-ungu	Tegemeo	Mbapa-saba
1	Ability to withstand drought	7	9	3						
2	High yielding	4	6	3	2	1	4	5	6	8
3	Early maturing	5	9	3	2	1	4	8	6	7
4	Ability to withstand Striga	5	9	3	2	1	4	6	7	8
5	Diseases/pest tolerance	7	9	3	2	1	4	6	5	8
6	Easy of dehulling	1	3	-	-	-	3	3	2	3
7	Good taste	3	7	5	2	1	6	8	4	9
8	Marketability	1	8	5	4	3	9	6	2	7
9	Whiteness of grain	3	9	5	4	2	6	7	1	8
10	Ease of threshing	1	2	6	5	3	9	8	4	6
	Total	37	71	36	23	13	49	57	37	64
	Ranking	**4**	**9**	**3**	**2**	**1**	**6**	**7**	**4**	**8**

MBEGU MPYA ZA MTAMA ZENYE UKINZANI DHIDI YA VIDUHA: "HAKIKA NA WAHI"[2]

Mbegu aina ya **Hakika**

Mbegu aina ya **Wahi**

Aina mbili za mtama Hakika na Wahi zimezalishwa na Kituo cha Utafiti wa Kilimo Ilonga kwa ajili ya kuoteshwa kwenye mashamba yaliyoathirika na viduha. Hizi mbegu zimepewa majina ya Hakika maana yake upo uhakika wa kuvuna kwenye shamba lililoathiriwa na viduha na Wahi inamaanisha kuwahi kukomaa.

Sifa za mitama hii ni:

- Huvumilia viduha
- Huvumilia ukame
- Hukomaa mapema

Mbegu hizi zina rangi ya manjano iliyopauka. Aina zote mbili za mbegu hizi zinafaa sana kwa kupika ugali. Hii inatokana na tathmini iliyofanywa na wakulima wa wilaya za Dodoma vijijini na Misungwi na kuonyesha ubora ulio sawa na mitama mingi ya kienyeji.

Wakulima wengi wa sehemu kame za Tanzania, wanaolima mitama ya aina mbalimbali hushuhudia mazao yao yakidumaa kwa sababu ya ukame na hatimaye kutoa mavuno madogo sana, pia hali hii husababishwa na mashambulizi yanayotokana na viduha kutoka kwenye mashamba yaliyoathirika na viduha.

Kwa nini viduha ni tatizo katika zao la mtama ?

- Mimea ya viduha, ni tegemezi kwa sababu hujishikiza kwenye mizizi ya mtama kwa kutumia mizizi yake na kupata chakula, na maji kutoka kwenye mtama Viduha pia hushambulia mazao mengineya nafaka kama mahindi na mpunga. Viduha haviwezi kuota bila kuwepo zao la nafaka.

- Mimea iliyoshambuliwa na viduha , hudumaa na kudhoofika kwa ukame kwa sababu hupoteza chakula na maji ambavyo huchukuliwa na viduha.
- Mashambulizi ya viduha ni tatizo mojawapo kwenye mashamba yanayozalishwa mazaoya nafaka mara kwa mara, yenye udongo wa asili ya kichanga ambao wakulima kwa nadra sana

[2] Fact sheet describing the characteristics of cultivars Hakika and Wahi.

hutumia samadi au mbolea ya chumvichumvi. Hii inatokana na ukweli kuwa viduha hustawi vyema kwenye udongo wenye rutuba duni ambao hushindwa kustawisha vyema mtama.

- Mitama mingi ya kienyeji na iliyotolewa kwa wakulima hapo awali ikiwemo Pato na Tegemeo, hushindwa kukua na kuzaa vizuri katika mashamba yaliyoshambuliwa na viduha.

Kwa nini tulime Hakika na Wahi ?

Baada ya kufanyiwa utafiti katika wilaya za Dodoma mjini, Dodoma vijijini na Misungwi kwa misimu sita, mtama wa aina ya Hakika na Wahi imeonyesha kutoa mavuno bora na mengi katika maeneo yaliyoshambuliwa na viduha. Aina hizi za mtama hukua haraka licha ya mashambulizi ya viduha, na huzaa vizuri zaidi ya aina nyingine za mtama.

Visifa vya Mbegu ya Hakika na Wahi

Sifa	Hakika	Wahi
Urefu wa mmea	Mita 1.4 hadi 1.6	Mita 1.3 hadi 1.4
Muda wa kutoa maua tangu kupanda	Siku 58 hadi 60	Siku 57 hadi 58
Muda wa kuvuna tangu kupanda	Siku 107	Siku 100
Rangi ya punje	Manjano iliyopauka	Manjano iliyopauka
Shina	Jembamba	Nene
Majani	Membamba	mapana
Idadi ya mavuno penye viduha	Tani 1.0 –2.0 kwa ha	Tani 2.0-2.5 kwa ha
Idadi ya mavuno pasipo viduha	Tani 1.5 – 2.5 kwa ha	Tani 2.5-3.0 kwa ha

Aina zote mbili za mtama zina:

- Ukinzani kwa ugonjwa wa mabaka ya majani (leaf blight)
- Zinastahimili ukame
-

Ushauri wa jinsi ya kupanda

- Aina hizi ni nzuri kupanda wakati wa mvua za vuli kwenye maeneo yenye misimu miwili ya mvua kama Kanda ya Ziwa na miezi ya Januari na Februari kwenye maeneo yaliyobakia yakiwemo ya Kanda ya Kati.
- Ili kukwepa kushambuliwa na ndege, inashauriwa kutopanda wakati wa mvua za kwanza.
- Maeneo ya Kanda ya Ziwa wanashauriwa kutopanda wakati wa mvua za masika ili kukwepa uharibifu unaoweza kutokana na mtama kukomaa wakati mvua zinaendelea kunyesha.
- Inashauriwa kupanda Hakika kwenye mashamba yenye rutuba haba na sehemu ambazo samadi haipatikani.
- Panda mbegu kati ya kilo 4 hadi 6 katika hekari moja.
- Wakati wa kupanda, weka ¼ kilo ya samadi kwenye kila shimo

Kuchagua mbegu kwa ajili ya kupanda msimu unaofuata:

- Chagua mbegu toka shambani masuke safi, makubwa na yaliyokomaa vizuri.
- Epuka kuchagua suke lililoshambuliwa na ugonjwa wa fugwe
- Chagua mbegu toka kwenye masuke yaliyo katikati ya shamba ili kupata aina bora ya mbegu ambayo haijachanganyika.

Paper D

Options for seed multiplication and distribution of new varieties in Tanzania

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Introduction

- ***Tanzania is heavily dependant on agriculture for its economic growth and development.***
- ***The small-scale agricultural sector will continue to be significant in Tanzania because the majority of the population is currently living in rural areas where small-scale farmers under take the bulk of agricultural production.***
- ***The absorption capacity of the non-agricultural sector to provide employment is limited.***
- ***Therefore people employed in the agricultural sector often face a high degree of economic vulnerability especial those in low income. A socially stable and economically viable small scale agricultural sector can act as a buffer in absorbing tensions and reduce economic vulnerability in situation in which economies are in transition as is the case in Tanzania.***
- ***In the past the seed sub-sector was dominated by the public sector in developing varieties, seed multiplication and distribution. In1973 TANSEED was established with the monopoly rights in the production, processing and distribution/marketing of all major food crops. Under this monopoly the formal seed sector produced less than10% of the National seed requirement.***
- ***As the government was undertaking Economic Structural Adjustment 1989 the policy changed to allow the participation of public and private sector in the seed industry. Although a number of foreign and domestic private seed companies entered the market involvement of the private sector was not increased as envisaged due to limited market demands.***
- ***To rescue the situation and to improve the availability of improved seed in rural areas where the majority of farmers live, the government has adopted a policy to encourage and facilitate both formal and informal seed production and marketing.***

Informal seed production system

- ***This is a traditional system where the farmer produces crop and makes a selection that will be used as seed in the next growing season. This is known as 'farmer saved seed'.***

Formal seed production system

- ***Two systems for the production of seed of known quality are now operating in Tanzania***
- ***The first involved companies producing certified seed.***
- ***The second and innovative system provides for community based production of Quality Declared Seed (QDS).***

- ***Seed certification applies strict quality control procedures and lays down seed grades:***

1. Breeder seed-handled by breeder
2. Basic seed-handled by Foundation farms
3. Certified I-handled by Foundation farms
4. Certified II-handled by seed companies

- ***The QDS system provides a quality control mechanism during on-farm seed production which is less demanding on government resources than seed certification. But this is adequate to provide good quality seed offered for sale by small-scale farmers. QDS is based on 4 principal points:***

1. A list of varieties eligible to be produced as QDS is established
2. Seed producers are required to register with an official seed quality control authority (TOSCA)
3. The authority (TOSCA) will inspect a minimum of 10% of the seed crops
4. The authority (TOSCA) will test a minimum of 10% of seed offered for sale under the designation Quality Declared Seed.

- ***Definition of QDS "Seed produced by a registered seed producer which conforms to the minimum standards for the crop species concerned and which has been subjected to the quality control measures outlined in the guidelines." These are:***
- ***The initial seed source shall be Maintainer's Seed or Certified seed from a registered source.***
- ***Quality Declared Seed may be used to reproduce further Quality Declared Seed only once.***
- ***No hybrid shall be produced under Quality Declared Seed system in Tanzania.***

Approaches to QDS production

Approach 1. ***Farmer Groups/Associations e.g. Christian Council of Tanzania (CCT)***

- ***Farmer groups bulked large quantities of seed of new varieties for sale at the village and distant communities.***
- ***Farmers were trained in seed production and general crop management.***
- ***1992/93 and 1993/94 CCT/RES distributed 968 and 436 mt of relief food respectively to Mara, Mwanza, Tabora, Singida,, Shinyanga, Kilimanjaro and Ruvuma.***
- ***1995 CCT embarked on Seed production in drought prone districts and the establishment of Village Seed Banks.***
- ***1996/97 CCT trained several Seed Inspectors in each of the districts at TOSCA Morogoro to undertake quality control activities in their own locations.***
- ***CCT facilitated many of the farmer groups to register as Associations or Co-operative societies and hence adopted QDS in seven participating regions.***

Approach 2

- ***Two farmers (Men and women) produce seed in a village in a programme supported by the ASPS/DANIDA Seed project***
- ***Farmers produced small quantities of seed to meet the demand of the village and neighbouring villages***

- ***Comprehensive training program in seed production was undertaken at different levels.***
- ***ASPS Phase I developmental Objective was to increase income and improve nutrition of poorer segment of smallholder in particular female farmers. ASPS covered 12 districts, Morogoro, Dodoma and Iringa regions in Phase I involving over 1,000 farmers.***
- ***ASPS Phase II developmental Objective was a sustainable increase in yield and improve yield capacity of field crops and vegetables grown by smallholders.***
- ***It is now envisaged that more districts may enter into QDS production with the support of the government and other donors.***

- ***Immediate objectives of phase II:***

1. By 2007, 2,000 farmers in 20 Phase II districts and 1,200 farmers in 12 Phase I districts produce QDS as a viable and self-sustaining business with total annual sales at least 1,600 tons (each farmer 1 acre producing 0.5 tons of seed)
2. Increase participation of women as producers and buyers of QDS; potential ensuring that women as economic partner in the household engages in seed production is explored e.g in the production of vegetable seed
3. All QDS farmers have adequate access to a continuous and sustainable supply of good quality basic or certified seed of new varieties of relevant field crops and vegetables

Approach 3

- ***Primary schools used for seed multiplication and as centres of seed supply in a project supported by SADC/ICRISAT***
- ***Targeted the production of small quantities of seed for sale to meet needs for parents in the village and neighbouring villages***
- ***It is an Integrated program involving ministries of Agriculture, Education and Local Government.***
- ***This is an attempt at using Rural Primary Schools as networks for the production and dissemination of improved seed that was regarded as viable project through which schools earn income and at the same time teach pupils practical agriculture.***
- ***Training on seed production was conducted to primary school agricultural teachers, Division Educational officers and district extension officers.***
- ***Pilot regions were Dodoma and Singida each with 1 district and 50 schools.***
- ***Crops were sorghum and pearl millet but now include other cereals and legumes.***
- ***Initial funds for procurement of foundation seed were provided by SADC/ICRISAT, however, the school had to procure their seed in order to sustain the system.***
- ***Plans are now underway to establish revolving funds to the participating districts and the project has expanded to include Tabora, Shinyanga, Lindi and Mtwara regions.***

Conclusion

There are now three models for community based seed supply projects in Tanzania and each offers valuable opportunities for an alternative seed delivery system to more formal seed certification. Each of these programs aims at promoting the adoption of new varieties in order to improve food security and alleviation of poverty in rural communities.

Paper D1

Cultivar diffusion patterns in Dodoma Region, Central Tanzania

J N W Mwanga
LPRI Mpwapwa

Background

- **Since 1996/97 the *Striga* project has been conducting on-farm trials**
- **Varieties were tested as a basket of seed**
- **Produce from trial was left for farmers**
- **A rational farmer will always find out the best option**
- **But what is happening to the seed?**
- **What are Farmers' decisions and actions?**
- **The best varieties tends to be demanded by other farmers**

Objective: **To monitor the on farm seed testing and cultivars diffusion patterns for the 1998,1999, 2001 and 2002**

Methodology :

- **Location: Striga project area (Mvumi-Makulu and Chipanga)**
- **A multiple visit survey**
- **Open-ended questionnaire was administered**
- **Data: (the yields, utilities &sales of sorghum varieties, seeds, seed offers)**
- **Sampling frame was the project participants**

Table 3.1 Distribution of participants in Striga control trials

Village	Ongoing farmers		Drop out		Total	
	N	%	n	%	N	%
Mvumi-Makulu	33	83	7	17	40	100
Chipanga-A	25	93	2	27	28	100
Overall total	58	87	9	13	67	100

Table 3. 2 Distribution of participants by village and seasons in Striga trials

Number of Season	Chipanga-A		Mvumi-Makulu		Total	
	N	%	N	%	n	%
5	3	11.1	5	12.5	8	12
4	4	14.8	0	0	4	6
3	9	33.3	3	7.5	12	17.9
2	6	22.2	13	32.5	19	28.3
1	5	18.5	19	47.1	24	35.8
Overall total	58	100	40	100	67	100

Production pattern for different sorghum varieties in 2001/2002

Table 3.3 Frequency of types of Sorghum grown by village

Sorghum type	Village		
	Chipanga –A	**Mvumi-Makulu**	**Total counts**
P9405	21	16	37
P9406	20	18	38
Pato	21	23	44
SRN39	0	2	2
Macia	17	15	32
Tegemeo	1	1	2
Lugugu	0	4	4

Table 3.4 Major source of Sorghum seed grown in 2001/2002

Source	Village		
	Chipanga-A	**Mvumi-Makulu**	**Total**
Seed project (SIDA)	1	0	1
Ilonga foundation research group	0	1	1
Own seed	8	10	18
Striga project	77	69	146

Table 3.4 Mean amount planted (Kg) for each variety by year.

	P5	P6	Pato	SRN39	Macia	SRN29	Tegemeo	Weijita	Lugugu
1998	0.5	0.5	0.73	0.5	0.5	0.5	0.5	0.5	-
1999	0.5	1.45	0.6	0.5	0.5	-	0.5	0.5	-
2000	0.5	0.7	0.6	0.5	0.5	-	0.5	-	-
2001	0.5	0.74	0.83	0.5	0.9	-	1.25	-	3.75

Table 3.5 Mean amount harvested (kg) for each variety by year:

Year	P5	P6	Pato	SRN39	Macia	SRN29	Tegemeo	Weijita	Lugugu
1998	43.8	8.3	107	25.3	6	35	110	-	-
1999	52.2	42	135	13.4	60.8	-	40	80	-
2000	14.5	17.8	63.4	10.8	20.2	-	-	-	-
200	34.17	42.6	82.1	10	70.5	-	60	-	172

1									

Table 3.6 Amount of yield (in Kg) used for food for each variety by year

Year	P5	P6	Pato	SRN39	Macia	SRN29	Tegemeo	Weijita	Lugugu
1998	58	57.1	149.1	53.8	10.5	7.5	77.3	-	-
1999	27.6	29.3	86.6	13.3	38.7	-	-	80	-
2000	20.4	22.2	77	14	31	-	-	-	-
2001	33.7	44.3	89	20	64	-	-	-	265

Table 3.7 Average amount of Sorghum sold in Kg by year: for each variety

Year	P5	P6	Pato	SRN39	Macia	SRN29	Tegemeo	Weijita	Lugugu
1998	151 (1)	-	-	52 (1)	-	52 (1)	72 (1)	-	-
1999	74 (1)	-	177 (1)	-	20 (1)	-	-	-	-
2000	-	-	45 (2)	-	20 (1)	-	-	-	-
2001	53.5(1)	-	60.19(13)	-	56.5(2)	-	60(1)	-	-

(*) n = number of cases.

Table 3.8: Amount (in Kg) reserved for seed by year for various Sorghum types

Year	P5	P6	Pato	SRN39	Macia	SRN29	Tegemeo	Weijita	Lugugu
1998	3.3	2.5	4	3	3	3	3	-	-
1999	2	2.1	3	5.7	4.7	-	-	-	-
2000	2.1	2.1	3.8	2	2.1	-	-	-	-
2001	2.9	3.6	6.0	-	6.3	-	-	-	8.7

Table 3.9: Average Non number of participant farmers who received seeds from research farmers

Year	P5	P6	Pato	SRN39	Macia	SRN29	Tegemeo	Weijita	Lugugu
1998	3	3	-	2	-	-	1	-	-
1999	1.7	1	2	-	3	-	-	-	-
2000	1.5	1	2	1.4	-	-	-	-	-
2001	3.1	2.8	2.3	-	4.1	-	-	-	-

Table 3.10: Average amount (Kg) of Sorghum donated by research farmers

Year	P5	P6	Pato	SRN39	Macia	SRN29	Tegemeo	Weijita	Lugugu
1998	3.8	1.5	-	1	-	-	20	-	-
1999	3.4	0.9	7.4	-	4	-	-	-	-
2000	1.4	1.6	9	-	2	-	-	-	-
2001	8.3	5.1	4	-	6.4	-	-	-	-

Table 3.11: Frequency of seed donation by year and variety

	Year					
Variety	**1999**	**2000**	**2001**	**2002**	**2003**	**Total**
P5	2	4	6	5	6	23
P6	1	7	5	4	14	31
Pato	2	4	5	2	-	13
SRN39	1	-	-	-	-	1
Macia	-	4	1	6	13	24
SRN29	-	-	-	-	-	-
Tegemeo	1	-	-	-	-	1
Weijita	-	-	-	-	-	-
Lugugu	-	-	-	-	-	-
Total	7	19	17	17	33	83*

(*) Farmers offered more than one variety

Conclusions on diffusion patterns of the improved varieties in the area

- **Farmer-to-farmer interaction concept.**
- **In the first and second season of the project few non-participants became interested in the varieties Macia, P9405 and P9406**
- **In the third and fourth season we see a number of farmers demanding the seeds.**
- **Seed offers ranged between 0.25 and 9 Kg.**
- **Pato which has been available for a number of years has diffused widely**

Other stakeholders involved in diffusion:

- **Dioceses of central Tanganyika (DCT),**
- **World Vision Chipanga area development project,**
- **ARI- Ilonga foundation seed project and the**
- **National Need multiplication Project funded by SIDA**

Lessons from the seed diffusion patterns:

- **In semi-arid, risk prone environments such as Dodoma it takes a number of seasons for farmers to assess new varieties before they decide to adopt them**
- **The risk, resulting from pests and drought (shock and trends) is high**
- **Farmers tend to mix seed of different varieties**

- **The varieties now being requested by farmers are P9405, 9406, Pato and Macia.**

The way forward and policy implication:

- **Heighten awareness through different learning tools**
- **Further training on seed production and storage**
- **Solution Sorghum Market dilemma**
- **Post harvest-handling and utilization to increase the shelf life**

Crop and soil management in the control of *Striga*.

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G Ley
ARI Mlingano, Tanzania

The following data showcase agricultural soil characteristics and the effect of manure addition on farms and on field station trials to elucidate the growth response of four sorghum cultivars to nutrient availability in the presence of *Striga*, with recommendations targetted at farmers in the Central and Lake Zones of Tanzania.

Tables 1 and 2 show the chemical characteristics of major agricultural soils in Lake and Central Zones as identified by farmers. These are all relatively infertile but Lake Zone soils have a greater range in fertility (Mbuga soil vs. Luseni).

Table 3 shows the effect on *Striga* and yields of adding 0.5 kg of farmyard manure (FYM) per plant to farmers' fields in which four cultivars of sorghum were grown. FYM increases yields, and generally suppresses *Striga*, but cultivar Pato can support more *Striga* when fertilised with FYM – explained from lab results showing increased germination stimulant production by Pato with extra nitrogen (N). The new cultivars Hakika and Wahi have very high yields even when no manure is added. Pato has poor yiekds in the presence of *Striga*.

Adding FYM increased the N & P contents of soils and sorghum leaves for on-station trials in the Central Zone (as shown in the first chart for Hombolo), but urea addition did not. Grain N was unaffected by both.

Cultivar Pato again yielded poorly without fertiliser addition, as shown for the second chart for Hombolo, but with FYM performed extremely well. Hakika and Wahi yielded well without any fertiliser, and yielded consistently well. Macia has an intermediate response.

Adding FYM, as shown in the third chart for Hombolo, decreased *Striga*, particularly for Pato, which supported large numbers of the weed. Urea also suppressed *Striga* (but did not result in extra N present in the soil or plant at the end of the experiment – indicating leaching). Hakika and Wahi support small numbers of *Striga* even without FYM addition.

Adding excessive amounts of FYM on a luseni soil at Ukiriguru (Ukiriguru chart 1) results in increased soil and sorghum leaf N in Hakika, available for plant growth.

Sorghum yields at Ukiriguru (second chart) are highest at the highest, excessive, levels of FYM application.

Table 1: Characteristics of major soil types recognised by farmers in the Lake zone.

Soil type		Chemical characteristics							
		pH (in KCl)	Organic C (%)	Total N (%)	C:N	Avail. P (mg kg^{-1})	CEC (meq. kg^{-1})	Ca (meq. kg^{-1})	K (meq. kg^{-1})
Lake Zone		Acid	Very low-medium	V. low- low	Good quality organic matter	Low-high	V. low-V. high	Medium-V. high	Low-V. high
Ibushi	**Clay loams to clay, grey/black. Moderate productivity.**	**5.8 ±0.06**	**1.5 ±0.04**	**0.11 ±0.002**	**13.3 ±0.32**	**6.2 ±0.64**	**21.2 ±2.40**	**16.1 ±1.78**	**1.0 ±0.11**
Itogolo	**Dark grey sandy clay loam. Moderate/poor productivity.**	**5.6 ±0.05**	**1.1 ±0.04**	**0.09 ±0.002**	**11.6 ±0.24**	**1.0 ±0.03**	**11.7 ±0.45**	**9.7 ±0.60**	**0.7 ±0.02**
Luseni	**Sandy, Red in lowland, white in uplands, unproductive.**	**5.1 ±0.02**	**0.4 ±0.01**	**0.04 ±0.001**	**11.9 ±0.28**	**4.2 ±0.60**	**1.6 ±0.05**	**0.9 ±0.04**	**0.1 ±0.00**
Mbuga	**Dark grey/brown, clay or sandy clay. Very productive.**	**5.1 ±0.06**	**2.1 ±0.06**	**0.17 ±0.005**	**13.3 ±0.34**	**10.8 ±1.10**	**71.6 ±0.60**	**39.3 ±0.47**	**3.1 ±0.04**

Table 2: Characteristics of the major soil types recognized by farmers in Central zone.

Soil type		Chemical characteristics							
		pH (in KCl)	Organic C (%)	Total N (%)	C:N	Avail. P (mg kg^{-1})	CEC (meq. kg^{-1})	Ca (meq. kg^{-1})	K (meq. kg^{-1})
Central Zone		Acid	Very low-medium	V. low- low	Good quality organic matter	Medium-high	V. low-low	Low-medium	V. low-medium
Isanga	**Coarse loam, sandy, yellow. Sorghum grows well.**	**5.6 ±0.07**	**1.5 ±0.05**	**0.13 ±0.002**	**11.2 ±0.33**	**18.4 ±2.16**	**6.6 ±0.27**	**4.3 ±0.12**	**0.7 ±0.02**
Isanga chitope	**Sandy clay.**	**5.3 ±0.03**	**0.5 ±0.03**	**0.05 ±0.003**	**11.6 ±0.30**	**14.9 ±0.98**	**4.8 ±0.23**	**2.3 ±0.12**	**0.4 ±0.03**
Ngogomba	**Grey clayey soil.**	**6.6 ±0.03**	**0.9 ±0.04**	**0.10 ±0.003**	**9.4 ±0.21**	**22.1 ±0.46**	**1.1 ±0.14**	**0.6 ±0.09**	**0.2 ±0.03**
Nkuluhi	**Red sandy clay loam. Low productivity.**	**5.3 ±0.10**	**0.8 ±0.02**	**0.09 ±0.003**	**8.2 ±0.13**	**10.3 ±0.96**	**6.4 ±0.22**	**2.7 ±0.14**	**0.6 ±0.03**

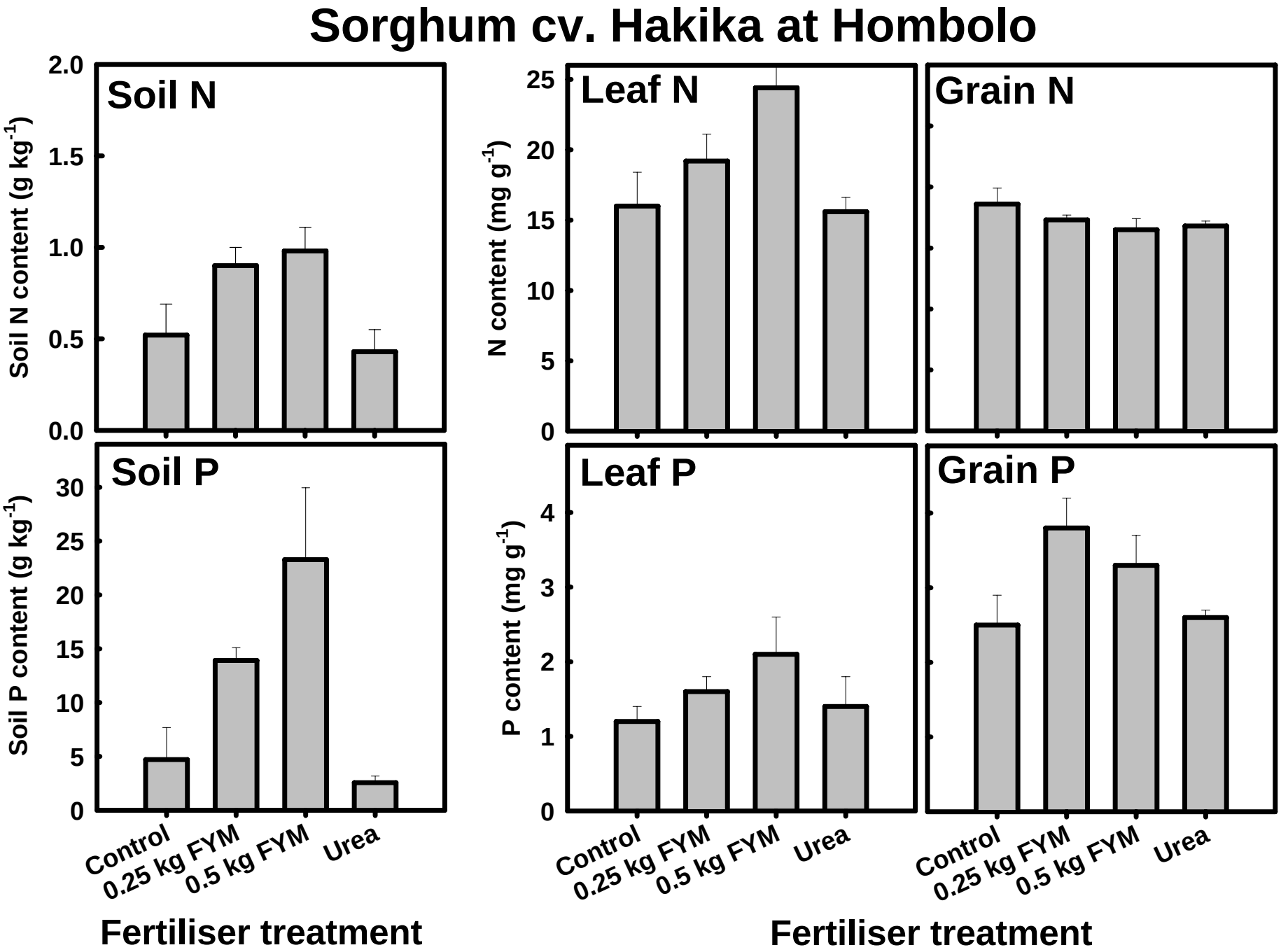
Table 3. The effect of farmyard manure (FYM) addition on numbers of emerged *Striga* and grain yield of different sorghum cultivars in a 25 m^2 plot of **(a)** nkuluhi soil belonging to farmer Richard Nyamwanji (Mvumi, Central Zone, Tanzania) and **(b)** luseni soil belonging to Ramadhani Mashara (Iteja, Lake Zone). Emerged *Striga* was counted at 12 weeks after planting (WAP) and at grain harvest (**a, b**), and at 9 WAP **(b)**. *S.h.* = *Striga hermonthica*, *S.a.* = *S. asiatica*. No yields are presented for **(b)** due to severe losses to insect pests subsequent to grain sampling for N & P contents.

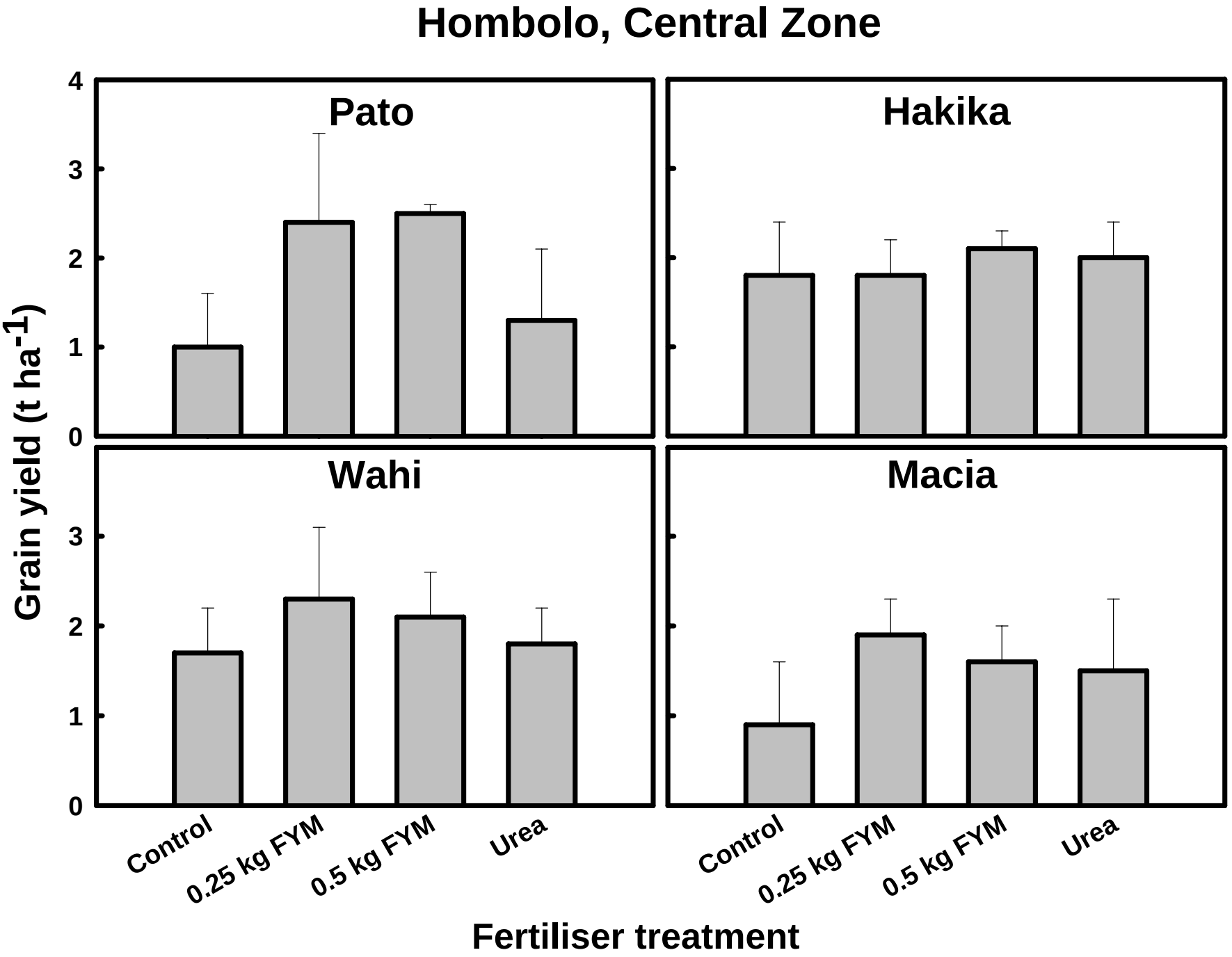
(a)

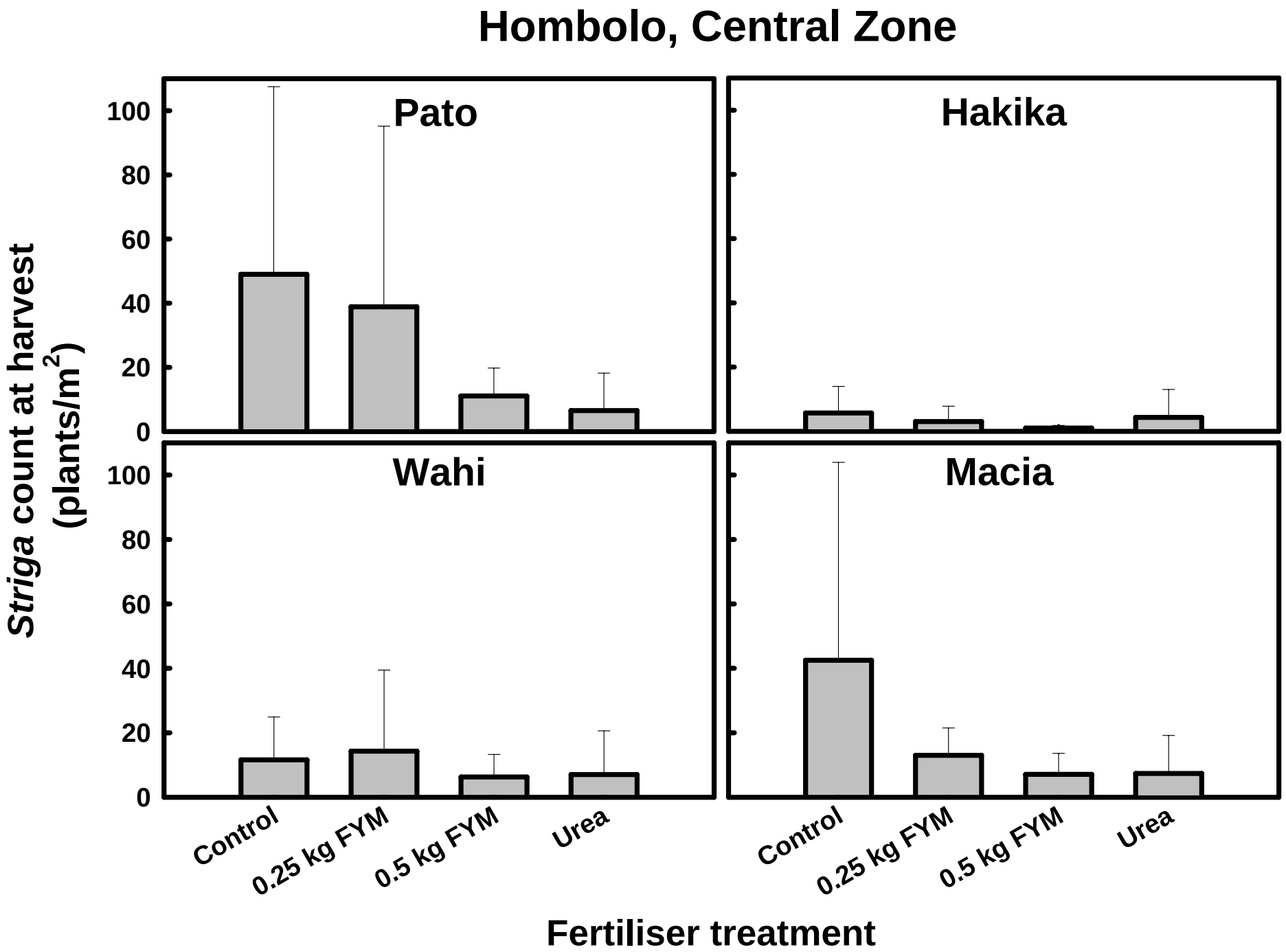
Cultivar	FYM application (kg/plant)	*Striga asiatica* count/plot (25 m^2)		Yield (kg/plot)
		12 WAP	At harvest	
Hakika	0	450	948	3.4
	0.5	61	325	4.5
Macia	0	105	2378	2.5
	0.5	73	1485	3.5
Pato	0	116	545	0.8
	0.5	340	892	1.1
Wahi	0	172	1204	3.1
	0.5	97	537	3.5

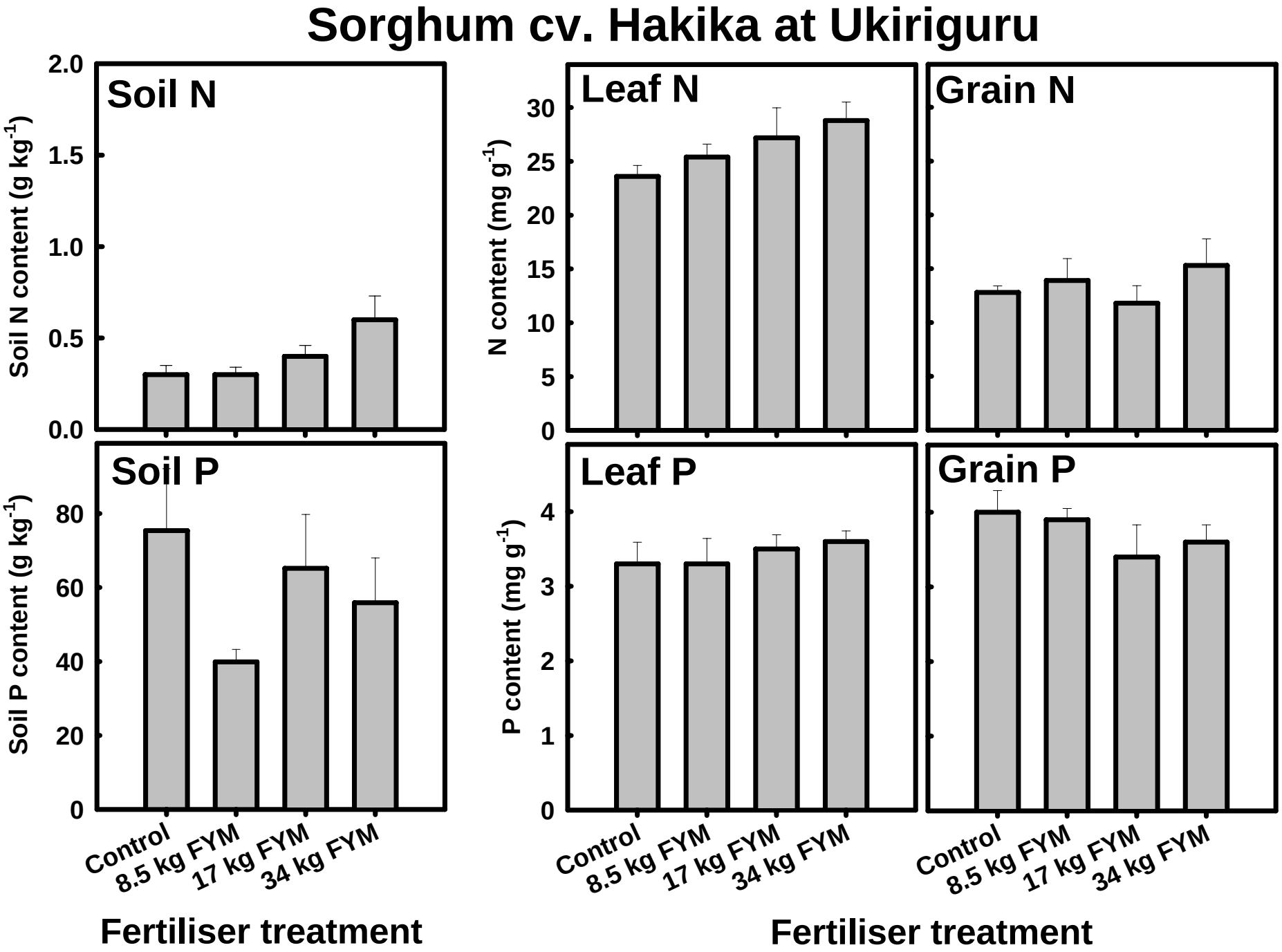
(b)

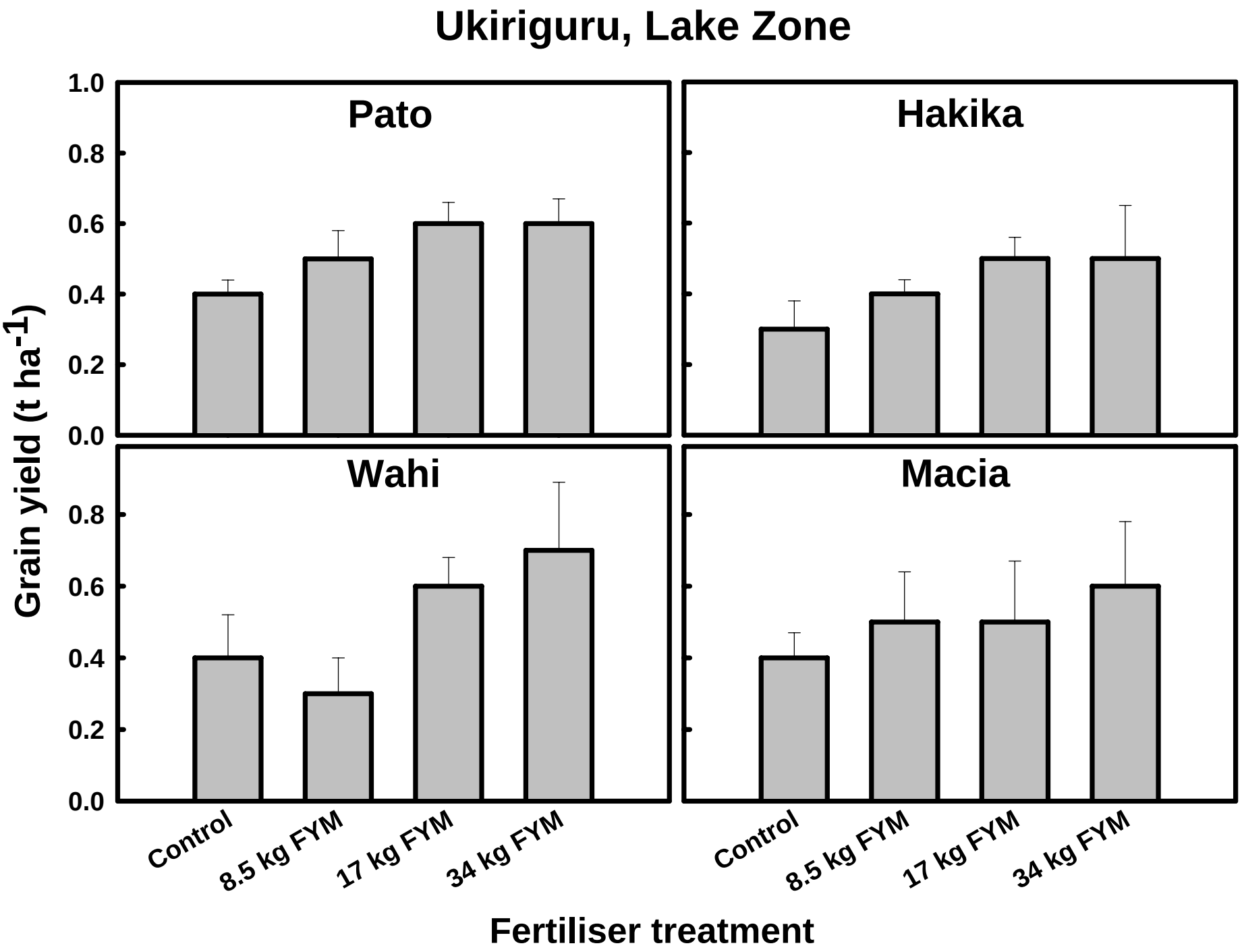
Cultivar	FYM application (kg/plant)	*Striga* count/plot (25 m^2)						Yield (kg/plot)
		9 WAP		12 WAP		At Harvest		
		S.a.	S.h.	S.a.	S.h.	S.a.	S.h.	
Hakika	0	0	10	0	11	0	19	-
	0.5	0	6	0	6	1	11	-
Macia	0	2	14	5	16	15	30	-
	0.5	1	10	5	18	10	25	-
Pato	0	0	32	0	30	2	60	-
	0.5	1	20	6	30	8	45	-
Wahi	0	2	15	6	19	10	30	-
	0.5	1	9	5	16	5	20	-


Sorghum cv. Hakika at Hombolo
Soil N
Soil N content (g kg-1)
2.0
1.5
1.0
0.5
0.0
Leaf N
N content (mg g-1)
25
20
15
10
5
0
Grain N
Soil P
Soil P content (g kg-1)
30
25
20
15
10
5
0
Leaf P
P content (mg g-1)
4
3
2
1
0
Grain P
Control
0.25 kg FYM
0.5 kg FYM
Urea
Fertiliser treatment
Fertiliser treatment


Hombolo, Central Zone
Pato
Hakika
Wahi
Macia
Grain yield (t ha-1)
0
1
2
3
4
Control
0.25 kg FYM
0.5 kg FYM
Urea
Fertiliser treatment


Hombolo, Central Zone
Pato
Hakika
Wahi
Macia
Striga count at harvest (plants/m2)
0
20
40
60
80
100
Control
0.25 kg FYM
0.5 kg FYM
Urea
Fertiliser treatment


Sorghum cv. Hakika at Ukiriguru
Soil N
Soil N content (g kg-1)
2.0
1.5
1.0
0.5
0.0
Leaf N
N content (mg g-1)
30
25
20
15
10
5
0
Grain N
Soil P
Soil P content (g kg-1)
80
60
40
20
0
Leaf P
P content (mg g-1)
4
3
2
1
0
Grain P
Control
8.5 kg FYM
17 kg FYM
34 kg FYM
Fertiliser treatment
Fertiliser treatment


Ukiriguru, Lake Zone
Pato
Hakika
Wahi
Macia
Grain yield (t ha-1)
1.0
0.8
0.6
0.4
0.2
0.0
Control
8.5 kg FYM
17 kg FYM
34 kg FYM
Fertiliser treatment

Conclusions:

Fertiliser

- Farmyard manure has a variety of beneficial effects. It increases soil quality, generally increases leaf N & P content, increases grain yield, and suppresses *Striga*.
- Urea has a transient effect when applied to Nkuluhi soil, suppressing initial *Striga* growth, but is then leached out of the soil and is unavailable to the crop.

Recommendations for fertiliser use:

- Any soil type may benefit from fertiliser.
- Both manure and urea can be applied to young crops to suppress *Striga*.
- Manure can be applied just once and will remain in the soil, and is recommended as a good all-round plant food.
- Urea is not recommended as it is not an all-round plant food and is washed out of soils. When used it should be reapplied periodically.
- Apply as much manure as you can acquire.

Sorghum cultivars

- PATO has very high yields when heavily fertilised with manure, but otherwise yields poorly.
- HAKIKA and WAHI are consistently high yielding, and support less *Striga*.
- MACIA performs moderately well.

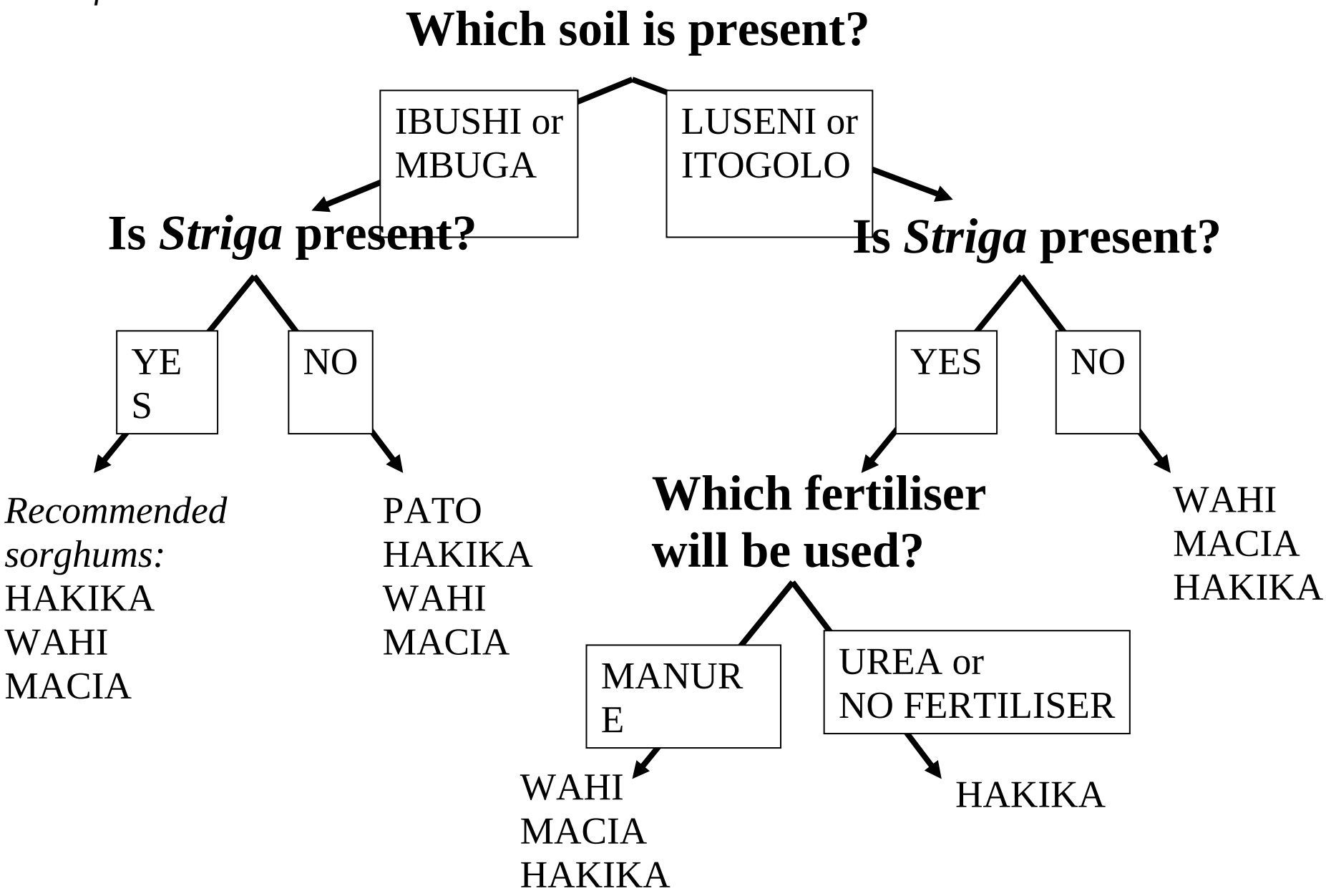
Recommendations for cultivar use:

- Hakika be preferred over other cultivars on extremely infertile and variable Luseni and Itogolo soils (Lake Zone) and Isanga chitope, Ngogomba and Nkuluhi soils (Central Zone).
- Wahi be preferred on more consistent, fertile Mbuga and Ibushi soils (Lake Zone) and Isanga (Central Zone), although Hakika and Macia are also good choices for these soils.

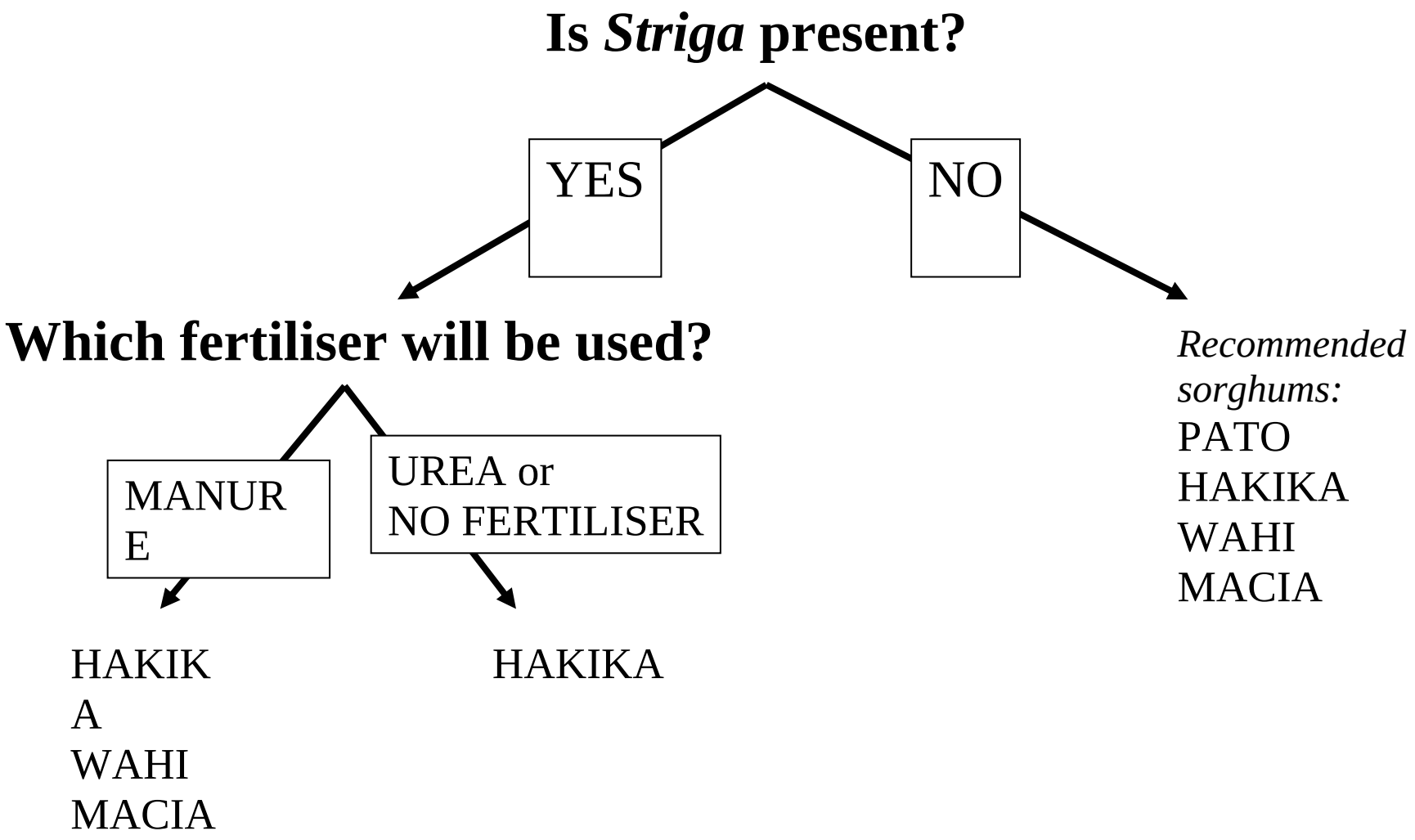
Decision Trees

The information presented above has been used to develop some simple decision trees which can guide extension advice on the choice of sorghum cultivar which is likely to perform best in different situations. These take into account soil type and presence or absence of *Striga*.

Decision tree for Lake Zone soils



Decision tree for Central Zone soils



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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Paper G
Striga control in upland rice in Kyela

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Introduction

Kyela is one of the potential districts in the production of rice in Mbeya Region. The Districts lay at the Southern eastern end of Mbeya Region on the floor of Rift valley between 33^0 40' and $30^0$30' Longitudes east; 90 25'and 90 40' Latitude South. The District is 478- 600 m above sea level. The climate of Kyela is warm and humid. The main rain season starts from November to June, and mean annual rainfall ranges from 2000 – 3000mm. In Kyela Rice is produced under upland rainfed and lowland flooded where the average production is 1- 2 t/ha. Rice is mainly grown as a food and cash crop where it occupies 37% of the arable land (Mwambungu, 1999).

Rice production is highly affected by a number of constraints including depletion of soil fertility, weed infestation, diseases and insect pests (Mwalyego *et. al,* 2001). The presence of *Striga asiatica* in upland rice has magnified the problem of weed to the extent of forcing farmers to substitute about 26% of the rice fields into other crops, remaining with about 40% of the rice fields under *Striga* attack (Mwambungu, 1999). *Striga* is called `Kyumika' in Kinyakyusa that means something that dries up the crop.
There two *Striga* species in Kyela as reported by Mbwaga *et al*,(2000), these are *S. asiatica* and *S. forbesii*. *S. asiatica* is found in rice fields attacking rice and maize grown in rice fields while *S. forbesii* is found in maize fields along rivers attacking maize only.

The *Striga* Problem

Striga is a very big problem in Kyela because it attacks the food and cash crop. It attacks the widely grown and highly preferred varieties Supa India (Kilombero), India Rangi (Rangi mbili) and Zambia. At the same time it has resulted some farmer to grow other crops that according to farmers they are low profitable crops eg cassava and sweet potatoes. Since population density of Kyela is high and creates land pressure then anything that can lower yield or forcing abandon fields or change crops threatens the livelihood of the people. Currently 2849ha of rice fields which is about 40% of the rice fields is infested by *Striga asiatica* as shown on the table 1.

Table 1: Rice fields under *Striga* Infestation in Kyela District

	Village	Area (ha)
1	Kilasilo	1106
2	Isaki	423
3	Kilambo(Itope Busale)	735
4	Sinyanga	350
5	Kanga	235
	Total	2849

(Source: Mwambungu, 1999)

Striga control strategies

The major objective of the *Striga* control research is to assist farmer to attain food security and improve household income by management of *Striga* through avoiding *Striga* infestation in *Striga* free areas, improvement of soil fertility, reduction of *Striga* seed in the soil and reduction of parasitism. In order to attain the goal the following activities were done.

Evaluation of Urea to control *Striga asiatica*

The trial was conducted on farm in two villages Kilasilo and Kilambo (Itope Busale) where 9 and 7 farmers participate respectively in the first season. Three levels of fertilizer Urea 0 kg/ha, 25kg/ha and 50kg/ha were applied in the fifth week after rice germination. Results showed that the use of Urea reduces *Striga* infestation by 67.21% and increased rice yield by 46.6% across sites (Table 2).

Table 2:Effect of fertilizer urea on Striga *and rice yield*

	Fertilizer levels Kg/ha			Fertilizer levels Kg/ha		
	0	25	50	0	25	50
	Striga count $25m^2$			Rice yield kg/ha		
Kilambo	9.7	5.3	3.6	555.7	915.7	1320.3
Kilasilo	8.6	4	2.4	1344.44	1731.11	2337.77
Grand mean	9.15	4.65	3	950.07	1323.41	1779.04

(Source: Kayeke, 1999)

Farmers appreciated the results of this research but due to unavailability and higher price of fertilizers in Kyela the technology was not practiced. During discussion farmers suggested the use of *Crotolaria spp* in rotation with rice. The idea of using *Crotolaria* came from farmers' experience back in 1992 under a research funded by PPIP. Then evaluation of *Crotolaria* started in farmers' fields

Evaluation of *Crotolaria* and Pigeonpea rotation with rice to control *Striga asiatica* in upland rice

Crotolaria has the ability to reduce *Striga* seed in the soil because it produces the germination stimulant for but is not infected by the parasite. It can also improve soil fertility like other legumes. In the first season the on-farm evaluation work concentrated on the rotation of *Crotolaria* with rice. Later the experiment was improved by introduction of pigeon pea for the same purpose as *Crotolaria* but with advantage of providing good source of protein for household food security. This research is conducted in Kilasilo and Kilambo (Itope Busale) Villages.

The layout of the experiment is as shown below

Crotolaria spp	Rice	Pigeon pea
Rice	Rice	Rice

In the first season the site will have *Crotolaria*, rice and pigeon pea, the second season all plots will have rice. This will enable a farmer to compare the number of *Striga*, rice yield from each plot. Farmers agreed the size of their plots for the sake of their convenience. They were advised to plow-under *Crotolaria* at flowering stage. Some farmers have decided to increase the size of their plots and some are testing C*rotolaria* mulch in other plots so that they can compare the results.

3.Introduction and promotion of *Crotolaria* in upland rice *Striga* affected area

Crotolaria has been introduced to assist farmers to improve depleted soil fertility and control *Striga*. Under this experiment the layout is as shown below

Crotolaria	***Rice***
Rice	***Rice***

In the first year the plots are planted to* Crotolaria *with rice folowing in the second season. This will allow farmers to assess the performance of rice after* Crotolaria *compared to rice after rice, and also the level of* Striga *infestation in all plots. Therefore rice yield and number of* Striga *will be assessed.

Under the same project 15 primary schools in the district has been included. This was done by conducting seminars with teachers responsible ffor agricultural activities in their schools. During the seminar they were taught the biology of *Striga* and control options including the use of *Crotolaria*. The main objective of involving teachers is to enable incorporation of awareness and control of *Striga* in the school teaching program. After the seminar teachers were supplied with *Crotolaria* seed to plant in school fields. Follow up will be undertaken later in the season.

Table 3: Number of participating farmers and plot size

Village	**Participating farmers**	**Plot size (m^2)**
Kilasilo	25	5 x 30
Kilambo	12	10 x 30
Sinyanga	12	10 X 20
Njugilo	12	5 x 20

Screening variety for *Striga* resistance

This experiment started with 26 varieties, after participatory screening 9 were selected for further observation in larger plots these are:

Rice variety	**Mean *Striga* 9th week**	**Mean *Striga* 12th week**	**Yield (t/ha)**
1.Dakawa 59	1.5	10.5	1
2.Line 41-27-10	2.0	6.5	1.7
3. Shingo ya Mwali	6.5	22.5	1.4
4. IR-47255-B-B-5-4	3.0	7.5	1.3
5. Zambia	2.0	5.5	0.7
6. Mwangulu Sel #19	4.0	8.5	1.5
7. ACC 102196	11.5	41.0	1.4
8. Supa India	3.0	5.5	1.1
9. Wahi wahi	3.5	9.0	1.4
Mean	**4.35**	**3.35**	**1.22**
SE	**0.49**	**1.10**	**0.17**

(Source: Mbwaga, 1999)

There is another set of rice seeds from WARDA received last season, the preliminary screening was done in one site (Kilasilo). Mean *Striga* number in the 9th week and the 12th week was determined.

Rice (lines)	**Mean Striga 9th week**	**Mean Striga 12th week**
1.WAB928-22-1-2-1-B 1.5	**7.0**	
2. WAB928-22-2-1-1-B 0	11.0	
3. WAB928-22-1-1-1-B 1.0	11.5	
4. WAB935-5-1-1-1-B 9.0		54.5
5. WAB935-5-1-2-1-B 8.5		31.0
6. WAB935-5-2-1-1-B 6.5		47.0
Mean	**4.42**	**27.0**
SE	**1.65**	**8.30**

The use of upland rice weeds (legumes) in the control of *Striga* in Rice

Under this study weeds *Mimosa invisa, Cassia obtusifolia* together with *Crotolaria* are used. They are:

- Plowing-under and mulched
- Assessed for their rate of decomposition in the soil and fertility improvement
- Assessed for their potential to stimulate germination and suppression of germination

This work is still in progress.

Future plans

1.To disseminate the use of *Crotolaria* and pigeon pea in rotation with upland rice to improve soil fertility and to provide another promising food and cash crop.

2.To look for suitable *Striga* control options to be used in maize fields because maize production is increasing in the District.

3. To look for a suitable control option for *Ramphicarpa fistulosa* a parasitic weed attacking rice in lowlands flooded areas.

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Paper G.

Reflections on *Striga* research and development

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Introduction

The Ministry of Agriculture and Food security appreciating that some of new technologies, developed by research, were not reached farmers made the following decisions:-

- To make sure that all new technologies are disseminated appropriately
- To make sure at least half of the time for research activities are used for disseminating technologies.
-

This meeting has provided a useful forum for stakeholders in the sorghum research to consider th future direction. The experience of the today's presentation shows that almost three quarters of expectations on the project have been met.

1. Importance of ***Striga*** as a weed

- Causes crop losses in cereals (sorghum, maize and up-land rice)
  - Poor plant growth
  - Plant wilting
  - Plant death before maturity

2. Farmers' awareness of the ***Striga*** problem

- Exemplified by various local names

3. Early work of ***Striga***

- Work carried out at Ukiriguru in the early 1950's.

4. Post independence work on ***Striga***

- **Limited work done by the National Sorghum and Millet Improvement Program**
- Collaboration with SADC/ICRISAT) SMIP
- Work continued in the late 1980's with structured surveys
- **Funding came from various sources e.g.**
  - FAO
  - Swedish SIDA
  - DFID

5. **Thrust of research work on *Striga***

- Variety development resistant/tolerant to *Striga*
- Fertility management options.

6. **Outputs of *Striga* studies to date:**

Control options such as

- Inter-cropping cereals with legumes
- Use of fertilizer and resistant varieties
- Use of post-emergence herbicide such as 2, 4 – D
- Use of crop rotations
- Hand weeding and early planting

7. **Scaling-up of options is now a priority**

- Multiplication and distribution of *Striga* resistant varieties
- Capacity building

Paper H

Review of crop protection issues in semi-arid Tanzania, in the context of sustainable livelihoods

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Introduction

Overall aim ***to assess the role and contribution of cropping to people's livelihoods in semi-arid E. Africa and identify the implications for CPP promotional opportunities and emerging research opportunities to address poverty.***

1. A review of the contribution of cropping (cereals, legumes and emerging cash crops) to livelihoods, particularly of poor people, in semi-arid areas of East Africa, including broad trends in production and marketing.
2. An assessment of the importance of crop pests and diseases in semi-arid areas and how they influence people's vulnerability, access to assets and livelihood/coping strategies that are used to respond to problems and opportunities.
3. Identification of supporting institutions, policies and processes which could promote crop protection technologies in semi –arid areas.
4. Recommendations, based on the above analysis, for promotional and research activities in the CPP Cereals and Legumes cluster

Approach

Adapted the DFID SL approach to provide a framework of analysis in order to relate crop protection issues to livelihoods in semi-arid areas.
Examination of the following:

- ***The livelihoods context and crops***
- ***The crop production context***
- ***Crop protection issues and coping strategies***
- ***Crop protection approaches and technologies***
- ***The institutional and policy context for uptake***
- ***Opportunities for crop protection promotion and issues for further research***

Three main steps:

- ***A one-day meeting of leaders of current projects in the cluster***
- ***A review of published and grey literature***
- ***Consultations with a wide of range stakeholders***

Geographical focus of review in Tanzania: Central Semi-arid Tanzania (i.e. mainly Lake and Central research zones)

Challenges in determining pest problems

- **Extent of damage loss not well documented**
- ***Differences of opinion regarding the importance of some pests.***

- ***Emerging pest problems information is scanty on new crops and varieties***
- ***Pest problems vary with location and over time.***
- ***Farmers' perceptions, knowledge and practices regarding pest management issues are generally not well documented.***
- ***Scientific and local knowledge is needed to determine priorities.***
- ***Few specialists with extensive crop protection field experience in the semi-arid areas.***

Crop protection issues and coping strategies

- A widely held perception that pests and diseases are responsible for a significant proportion of crop losses
- Farmers' perceptions, knowledge and practices regarding pests, diseases and weeds do not appear to be well documented and should be an important entry point prior to interventions
- Farmers are unlikely to invest in external inputs for most crops and most households have a significant labour constraint. Technologies/ approaches to address crop protection issues must take these factors into account e.g. varieties, low external input technologies with a high return to labour.
- Higher value crops e.g. vegetables and crops grown for seed represent opportunities for more significant investment in pest management.

Progress with promotion/uptake

- ***Products (varieties) and knowledge (management methods) not widely disseminated***
- ***To do this effectively and in a sustainable way depends on a well-informed promotional strategy for the semi-arid areas.***

Need for appropriate research & development strategies

- ***R&D strategies for less-favoured areas including semi-arid locations, are likely to differ significantly from those needed for more favoured areas.***
- ***Strategies need to work within the constraints of a risky agro-ecologoical environment and limited infrastructure, limited research coverage, government extension services that are thin on the ground, NGOs with interest but often limited coverage, and a poorly developed private sector for input distribution and marketing.***
- ***People in these areas often have limited assets, however, are seeking knowledge and technology***
- ***R&D strategies should fully take into account an analysis of the uptake environment.***

Uptake environment

- ***Uptake environment is challenging but opportunities exist***
- ***NGOs - technology promotion and market development***
- ***Public sector agencies- reform programmes, decline in funding, decentralization***
- ***Food and seed relief programmes- may have undermined past efforts, but also an opportunity***
- ***Local seed production schemes***
- ***FFSs- learning centred-approaches, although capacity issues***
- ***Private sector is not well developed, but policy aims to enhance opportunities***

- *The Agricultural Sector Development Strategy (ASDS)* ***arose in response to the Poverty Reduction Strategy Paper and the primary objective of the strategy is to create an enabling an environment that is conducive to improvement of agricultural productivity, in order to improve farm incomes and reduce rural poverty.***

- ***The ASDS identified 5 strategic issues that need to be addressed:***

- Strengthening of the institutional framework
- Creating a favourable environment for commercial activities
- Public and private roles in improving support services
- Strengthening marketing efficiency for inputs and outputs
- Mainstreaming planning for agricultural development in other sectors

Towards a promotional strategy

- ***A promotion strategy is needed to capture research benefits funded by CPP and others.***
- ***Need to build on existing initiatives***
- ***What is already happening?***
- ***What else needs to be done?***

Specific promotional opportunities:

Four main areas of opportunity for promotion can be identified:-

- *Promotion of pest, disease and weed tolerant adapted varieties* ***that meet local requirements, including marketing opportunities, provides farmers with a low cost option for reducing risks and improving food security and diet provided these varieties can be disseminated effectively - eg small grains (sorghum and millet), maize and legumes (cowpeas, pigeon peas, groundnuts),***
- *Low external input pest, disease and weed management techniques* ***have a potentially important role to play in improving household food security and income, but many require knowledge intensive/ learning-centred approaches***
- *Seed management* ***is a potentially important means for controlling some important diseases (e.g. covered kernel smut), and is amenable to either a mass media/ larger scale approach that could also be combined with seed distribution or a more learning-centred approach as above,***
- *For higher value crops* ***in areas with market access,*** *IPM* ***including selection and management of chemicals, pest scouting and use of local botanicals is an area of interest to farmers and potentially important for improving returns to farming and reducing risks of crop failure.***

Future research opportunities

- ***Agricultural research to target poverty and /or less favoured areas:***
- ***Client-oriented problem (opportunity) focused approach;***
- ***Understanding and responding to the needs of vulnerable groups;***
- ***Increasingly central role of women in agriculture taken fully into account;***
- ***Need to address institutional incentives;***
- ***Importance of partnerships;***
- ***Public and private sector investment;***
- ***Information and communication strategies;***
- ***Approaches that stimulate and build on farmer innovation and knowledge;***
- ***Technologies which reduce risk and conserve and improve resources;***
- ***Technologies which improve returns to labour as well as land.***

Future research must be informed by an understanding of what currently drives decision-making in crop production for the majority of households in semi-arid areas. .

- ***Research to support*** *food security* ***should focus on*** *breeding/selection of varieties* ***of the main food crops for tolerance to the main environmental challenges (weeds, insect pests, low soil fertility, diseases) as well as post-harvest attributes e.g. storage and marketability.***

- ***Research may also look at*** *low input pest management practices* ***such as seed management, appropriate forms of inter-cropping, field sanitation, crop rotation and use of locally available botanicals for food crops.***
- *Crop utilisation and marketing issues* ***need to be addressed in parallel with CP research.***
- ***For*** *higher value crops* ***(e.g. vegetables, fruits, and high value legumes),*** *IPM* ***including more effective use of chemicals and local botanicals (for production and storage) is a research area which can be developed in partnership with agencies supporting marketing activities.***

Paper I

Recent outputs from Crop Protection research at LZARDI Ukiriguru

J Sato
Lake Zone Agricultural Research and Development Institute, Ukirigiru

Introduction

The Lake zone mandate area comprises Mwanza, Shinyanga, Mara and Kagera regions. The major problems, which affect crop production in the zone, include:

- Low soil fertility
- Pests and Diseases
- Weeds problems

Research has contributed to the efforts to increase food security by multiplying sorghum varieties Macia and Pato in Iteja and Mwagala villages in Misungwi District. However the *Striga* affected almost all of the available and released sorghum varieties. The LZARDI programme in collaboration with the National *Striga* project looked for alternative varieties, which can tolerate *Striga*. This led to the identification of recently released sorghum varieties Wahi and Hakika

Other methods investigated to reduce *Striga* damage include:

- Inter-cropping sorghum with a legume
- Crop rotation
- Uprooting of *Striga* and burning was also recommended but it was found laborious

For diseases

Maize varieties with gene for maize streak resistance were evaluated and these include

Kilima -ST
TMV1- ST
Katumani -ST
Staha

For other crops like cassava and sweet potato

The research outputs have included

- Resistant/Tolerant cassava varieties against CMD- Tms 4(2) 1425, Tms 81983, and others
- Predatory mites against CGM were identified and introduced in the zone
- Hilling-up of sweet potato to reduce sweet potato weevil was recommended
- Tolerant varieties against Sweet Potato virus disease were identified e.g. Polista

For cotton

- Scouting technique recommended in order to reduce use of pesticide
- Use of botanicals to control cotton pests has been investigated

Paper J.

Zonal research information management, zonal linkage and liaison monitoring: Towards extension and dissemination

R S. Tuni
Lake Zone Agricultural Research and Development Institute, Ukirigiru

Activities of the Zonal Research Extension Liaison office

The main activities are:

- Agricultural research information and dissemination of output
  - Collect from processors
  - Compile
  - Process into friendly user formats
  - Coordinating and conducting training sessions for clients
  - Disseminate technologies directly or indirectly via other stakeholders

Co-ordination of dissemination activities is through the Linkage/Liaison Monitoring Committee co-ordinated by ZRELO. The committee deals with all activities related to information provision and management, monitoring and dissemination of research. The Information Management Committee Handles information and data related to agriculture for stakeholder needs, information, documentation services and, scientific and technical data banking.

- **Coordinates publication – Zonal, station and International levels**
  - Research reports
  - Newsletters
  - Leaflets
  - Posters

- **Promotion of Zonal Research activities through:**
  - Institute flyers
  - Calendars
  - Staff business cards
  - Mass media (radio programs, television and local newsletters and journals)

LMC Dissemination channels/strategies

The research output/technologies are usually disseminated by the Linkage Monitoring Committee (ZRELO, RELO and DILOs, ZCCO) through:

- On-station open days (dissemination demos)
- On-farm research activities with FRG and FEGs (dissemination, testing, verifying, demos etc.)
- Farmers field days and agricultural shows (Research, Extension and farmers interactions in learning and feedback).
- Stakeholders meetings (research request meeting)
- District DSMS, quarterly workshops (Training, technologies, develop, dissemination)
- Activities, newspapers/letter
- IPR, ZTC and ZEC (approve proposals
- Direct ordering from stakeholders
- Sending a package of research output to DALDOs etc.

Research output production (IMC)

- Research reports in the form of Field notes, Working papers, Articles in Journals etc.
- Extension materials such as Leaflets, Posters, Brochures, Technology Reference books, Articles in Newspapers and Newsletters.
- Training materials such as Training manuals, modules
- Publication of promotional materials: Institute flyers, Business cards, Calendars, T-shirts and caps bearing the Institute's LOGO

Production modalities (ZIMO)

Field notes and working papers

- Scientist original research results
- Research project report submitted to ZIMO
- Reviewing (at least three reviewers that are assumed to know the scientific output of research project).
- Resubmitted to ZIMO
- If the document qualifies for publication is then submitted to the Author to incorporate the necessary corrections and comments before the final copy is published.

Leaflets, Posters and training modules (ZIMO)

- Production week is organized by ZIMO for each output
- Guidance is provided
- Draft production are submitted for discussion and general review
- Second drafts are produced and submitted for review (at least three reviewers per each publication)
- Incorporation of corrections
- Testing involving stakeholders (farmers and extension agents)
- Finalization
- Printing final copy

Journal articles are subject for review by external reviewers

Future plans (IMC and LMC)

- Radio and television programs
- Technology reference book
- Video library for technologies
- Specific agricultural recommendations to stakeholders
- Stakeholders sharing costs of research output development and dissemination
- Strengthening linkage and backstopping FRGs, FEGs, FFS.
- Organize and participate in seed fair shows

Paper K

Farmers Field Schools activities in Kagera

T Julianus
East African Sub-Regional Pilot Project for Farmers' Field Schools
Kenya, Tanzania and Uganda, Bukoba

Introduction

The program was established to support community study of ways of overcoming banana disease and mosaic cassava mosaic virus. The major objective being food security and poverty alleviation. The program is implemented by FAO in close collaboration with the IFAD KAEMP project, agriculture departments and local government in the Bukoba and Muleba districts. Training inputs are provided through from CABI Nairobi

The major production constraints in the target districts are:

BANANA

- ***Banana weevils***
- ***Nematodes***
- ***Black/yellow Sigatoka disease***
- ***Fusarium wilt (Panama disease)***

CASSAVA

- ***Cassava green mite (CGM)***
- ***Cassava mealy bug***
- ***Cassava mosaic disease (CMD)***
- ***Cassava bacterial blight (CBB)***

TECHNOLOGIES/IPM OPTIONS

- ***corm planting***
- ***corm paring and hot water treatment***
- ***resistant varieties (banana and cassava)***
- ***soil fertility restoration through use of leguminous plants (*Mucuna, Canavalia, *etc), making compost, cover crops and mulching.***
- ***use of free sites and sequential planting***
- ***rapid multiplication of resistant varieties***
- ***identification of CMD resistant local varieties through variety gardening***
- ***good crop husbandry***

Activities carried out 2000-2003

1. ***Curriculum development – workshop with resource persons - integrated***
2. ***Training of trainers – capacity building***
3. ***One month training course for 23 extension staff***
4. ***Follow up TOTs for 23 extension staff (0ne week) - zigzag***
5. ***Two training for farmer trainers(refresher course) – 90 farmers***
6. ***Regional meeting and workshops***
7. ***Planning/preseason workshops***
8. ***Evaluation workshops***

Implementation

117 Farmer Field Schools
90 FtF Farmer field schools (90)
Farmer forums
Farmer to farmer cross visits
Formation of farmer networks
Small animal FFS (SPI)

Training of Trainers

The system requires technically strong facilitators with a basic knowledge of crop agronomy, livestock or soil. Good facilitation skills are needed as the facilitators work closely with farmers. These are facilitators and not instructors. The aim is not to t transfer technology but rather to generate technology

The process should be demand driven and participatory

Curricula development workshops for TOTs leads to TOT training curricula
Gap analysis during TOT provides facilitators with a training guide
Gap analysis during initial stage of farmer field training provides an opportunity to fine tune farmer training programs to reflect farmer needs

The FFS aim to be Integrated

Entry point/main theme is IPM (ICM), ILM, SPI but other aspects such as Marketing strategies, Gender topics, Health – HIV/AIDS awareness, nutrition, basic financial management skills, record keeping and farming as a business (FAAB) are included in the curricula.

Typical FFS session

AESA, Special topics, Group dynamics, On-farm trails, AESA – core activity-entails field observation, analysis and decision making. Management decision making tool

Sessions held one once a month for banana and weekly for other crops. Records are made of Crop vigor/stand, diseases, pest incidence, weather and soils.

Special topics

Designed to strengthen sessions in particular topics to provide comprehensive learning – e.g. on pest and diseases using various techniques e.g. an insect zoo
Extra curriculum subjects e.g. marketing, health, and gender

Group dynamics and ice breakers

Develop group cohesiveness
Problem solving skills
Encourage collaboration and creativity

Physical exercises and brain teasers
Fun to the group – refreshing environment

On farm trials

Testing & validation of technologies and options
Fertilization trials on banana – different FYM rates, compost
Mulching to the base for nematode evaluation
De-suckering & de-trussing of banana stools

Innovations

The project is testing out a number of ways of making the process sustainable e.g. Grant systems, pay for the facilitator, group bank accounts, group management of own funds, foci model, farmer to farmer extension, networking and an integrated curriculum

Sustainability Issues

Program sustainability

Ministry mainstreaming
Local government & other NGO (Institutionalization)

Technological sustainability

Adaptable, accessible, & maintained

Group sustainability

Commercial act., registration, constitutions, networking

Next steps

Establish soil productivity improvement SPI FFS
Continue with on going diversification to other crops and agric. enterprises
Commercialisation and marketing through FFS Network groups - FAAB
Recruiting more farmer trainers
Scaling up to other areas

Paper L.

Catholic Relief Services activities in Lake zone

D. Rwegoshola
CRS, Mwanza

1. INTRODUCTION

CRS works with researchers and collaborators.
In the Lake Zone (CRS) Focuses on grain legumes of high market value

Grain legume have been selected and given a priority for four main reasons

1) Drought resistant/ tolerant
2) Resistant to pest and diseases to a high degree
3) Food and income security needs of farmers given their high value market
4) Referred to as women crops and therefore being more supportive and responsive to the needs of women in the Lake zone.

2. PARTNERSHIP

The NGO KIMKUMAKA is one of CRS partner organizations involved in pigeon pea production and testing. Brian Pokingham the director of KIMKUMAKA was asked to share with the participants his real – life situation experience in solution to crop protection related activities.

3. CROP PESTS:

KIMKUMAKA is currently monitoring 304 trials of pigeon peas. Pests as opposed to what was expected currently affect the trials. According to Kenya and Uganda experience pigeon peas is tolerant resistant to pest attack. The extent of crop damage in our on-farm trials is not high but it is worth noting the fact that the crop has been attacked.

-" Neem tree" and *Tephrosia* natural organic methods of pest control are used to reduce the magnitude of the problem.

We are working with ARI Ukiriguru as COR Collaborators to find ways and means to address the problem of pest attack at early stages of crop growth and development.

Paper M.

Tanzania home Economics Association (TAHEA) Household food Security and Technology Transfer project

Asia Kapande.
TAHEA, Mwanza

INTRODUCTION

Tanzania Home Economics Association (TAHEA), is a national Non-Governmental organization founded in March, 1980, with a mission or primary goal to promote improvement of quality of life of families particularly of women. It is registered, No. SO. 6179 under the Tanzania Societies ordinance in 14th October 1980 founded by 17 members (Home Economists). Members are Home Economists, related sciences such as Agriculture, Community Development, Health, and other sciences. TAHEA membership has expanded from 17 to over 1000 by year 2002.

TAHEA has been working in partnership with CARE International in Tanzania (Funded the Project), local government, TAWLAE, TSAEE, ARI Ukiriguru, MATI Ukiriguru, Rural Development Resource Centre and the villagers of Mwasonge (Misungwi District) and Luchelele village of Mwanza rural (Nyamagana New District). The project operated from 200 to 2002.

Goal

To increase Food Production and financial status of the participating households.

Target Population, Directly – 200 people, indirectly – over 2000
People, women and men at Mwasonge and Luchelele villages

Activities

Sweet Potato

Vines were obtained form ARI Ukiriguru using clean vines of different varieties,

- Sinia
- Simama
- Juhudi
- And Orange Fleshed Sweet Potato varieties

- 5000 bundles of 300 vines per bundle were available, distributed to different beneficiaries' fields, village members and other neighboring villages in Misungwi, Nyamagana and Ilemela districts.
- Sweet potato – 17,500 bags each with 100kgs were harvested, from both villages for the two years of the project implementation.
- 175 bags of Sweet Potato chips were processed and sold.

Utilisation

- The beneficiaries consumed more than 80% of the harvested sweet potatoes.
- 20% of the sweet potatoes were processed and sold for income generation.
- Money obtained was used to pay tax, school fees for their school children, Health services and purchase of other household facilities.
- Some of the money was used to purchase building materials such as Aluminum sheets for roofing their houses, Timber, cement and nails.
- Loan repayments for the treadle pumps used for small-scale irrigation as well as Ox-carts for the transportation.
- The repaid money is being banked in the CBO umbrella Leadership group account at the National Micro finance Bank. at Kenyatta Branch.

Utilization of Sweet Potatoes

- In relation to post-harvest handling the villagers have been taught, different ways of preparing sweet potatoes such as dishes mixed with various legumes e.g. peas, beans, green gram, bambara nuts, chick peas, groundnuts and other legumes. This exercise was conducted to make the villagers understand the importance of sweet potato production and various methods of food preparation to avoid monotony of boiled sweet potatoes as daily meals in a household.
- Processing, preservation and sun drying as well as use of a Solar drier, for the processed sweet potato chips was undertaken with the farmers. They are now are very conversant with all the different methods cooking, making balanced meals by using sweet potatoes, mixed with legumes and vegetables. Making of confectionery such as doughnuts, cakes chinchin and chapati has been appreciated by the villagers. The above products are better utilized in the morning as breakfast bites.

Group Formation

Each village formed 10 groups after a two weeks training at MATI Ukiriguru.
The ten groups elected leaders to form the CBO umbrella group.

Exit strategy

The groups were advised and agreed to build a house for meetings and other activities. Mwasonge umbrella group mobilized the 10 groups to contribute cash and in kinds. Both men and women had to collect sand, stones and gravel for the building. The completed building is used for CBO meetings, selling of the food crops and other gathering events. CARE International in Tanzania, TAHEA, MATI Ukiriguru and Villagers contributed money for the building.

Sustainability

The groups obtained labor saving devices, which assists them to reduce workload for better production of sweet potato for food. Vines as planting materials, which are raised during the dry season to be utilized during the rain season. An umbrella leadership group will assist sustaining the 10 and more groups formed in both villages.

Conclusion

During the project implementation a number of people visited the project areas. These included post-harvest specialists from CIP Nairobi and Kampala, staff of ARI Ukiriguru, Local government officials from Misungwi District, MATI Ukiriguru and some officials from the Ministry of Agriculture Dar es Salaam, the Canadian High Commissioner and the First Secretary (Development) as well as other stakeholders.

The villagers improved their perception for sweet potato growing as a cash crop and men participated very well, though before the project, men perceived as sweet potato as a woman's crop. Some farmers preferred sweet potato production as an income generation crop better than tomatoes and other horticultural vegetables. The later are too demanding for agricultural practices for better and quality production.

Tanzania – GTZ – IPM Experiences and Issues in Lake Zone

J Muro
IPM Shinyanga

1.0 Introduction

The Integrated Pest Management (IPM) Project started in Shinyanga Region in May 1992. The Region was chosen as a pilot area for developing and introducing the IPM concept before it could be disseminated in other regions. Integrated pest management (IPM) is one of the major crop protection methods has been adopted by farmers in Shinyanga region to reduce the crop damage and yield losses caused by insect pests, diseases and weeds. Main components of IPM include cultural, sanitation and biological control while chemical control is considered as the last option. The increasing application of the IPM method is the result of its effectiveness against crop pests weeds and diseases, as well as the influence of the high costs of chemical control and its negative impacts on the users, domesticanimals, wildlife and the environment in general.

2.0 The aim of IPM

IPM is a concept, which aims at reducing crop losses caused by pests below economic importance (economic level threshold level) in an economically and ecologically sustainable way. IPM is generally defined as a systematic combination of different method including cultural, biological, physical, phytosanitary and chemical to reduce pests (i.e. insects, rodents, birds vermin diseases and weeds) below the economic threshold, by using economically and ecologically appropriate and sustainable methods at pre-and post-harvest levels. IPM strategies have been developed for different crops such as Maize, Sorghum, sweet potatoes and cotton. They consist of a number of different measures/recommendations, which need to be combined in integrated in order to achieve optimum efficiently.

The strategies often provide farmers with options and are therefore different from conventional packages. Also these technologies could be used by small farmers with low or avoidable costs which can be able to increase the quantity and quality of yields.

3.0 Approaches for IPM development

The main IPM objective in Shinyanga has been to increase and sustain food security at household level by reducing the crop damage and yield losses caused by crop pests, diseases and weeds. The farming system in the region was described in a base line and succeeding diagnostic surveys. Thes yielded the basis for priority setting concerning crops, farmer's and technical needs and possible IPM strategies in the context of the region. It also gave a database for monitoring project effectiveness.

Diagnostic and monitoring surveys deepened the knowledge on the farming system and on specific problems. Socio-economic surveys (farmers priorities and practices, yield levels, costs and prices and gender responsibilities).
Pest and beneficials surveys (inventory, distribution and loss assessment).

4.0 General IPM technology developed

IPM concept is an approach designed to retrieve agriculture. It has become clear that agricultural system are designed and managed holistically to stress the health of the crop on a well managed environment. Pesticide application can be drastically reduced or can be avoided altogether.

Generally, IPM in Shinyanga region was implemented focusing on two different situations

- In food crops such as cereals (Maize and Sorghum) and sweet potatoes where little or no chemical control has been previously used.
- In commercial crops (cotton) where an overuse of chemical control had taken place.

For practical reasons, IPM whose effective application is based on the best mix of environmentally sound techniques in order to keep pests below the economic damage threshold, which implemented under five components:-

Cultural control measures

- Crop rotation and fallow.
- Inter-cropping.
- Weeding.
- Soil fertility improvement.
- Timely planting.
- Hygienic measures.

Use of resistant/tolerant varieties.
Mechanical control
Biological control measures
Chemical control measures.

These IPM control measures or recommendations developed were environmentally safe methods that are economic sound and can be applied by the average farmers for all crops. To our experience a systematic combination is needed in order to be effective and to increase the quantity and quality of yields.

4.0.1 IPM Control strategy in Cotton

Integrated Pest Management strategies in cotton try to keep pests, disease and weeds under economic threshold by combining.

- Cultural (rotation, sowing rate, row planting, Ox-drawn weeder, timely planting and frequent picking).
- Biological (seed varieties, enhancement of beneficial.
- Sanitary (stalk management, cleaning of stores
- Chemicals (scouting, pesticide selection, and pesticide application).

4.0.2 IPM Control strategy in cereals

Integrated Pest Management Strategies in cereal try to keep pests diseases and weeds under the economic threshold by combining.

- Cultural (rotation, sowing rate, inter-cropping patterns, row panting and Ox-draw weeder).
- Biological (seed varieties, enhancement of beneficial.
- Sanitary (Stalk management, selection of clean seeds, destruction of parasitic weeds.

4.0.3 IPM Control strategies in sweet potatoes

IPM strategies in sweet potatoes include

- Cultural (rotation, hilling up and crack filling rapid multiplications).
- Sanitary (Selection of clean planting material field hygiene and processing).

4.0.4 IPM control strategy for *Striga*.

Striga are root parasites specialized on maize and sorghum. To a small degree they also attack wild grasses and sometimes finger millet. *Striga* occurs in about 50% of the maize and sorghum fields in the region. Average damage there is around 15%, but can vary from 0 to 90% yield loss.

S. hermonthica and *S. asiatica.* are both common in Shinyanga, Mwanza, Tabora and Mara.

Each plant produces thousands of seeds, which are source of infestation for the next season. The seeds are viable in the soil for more than 5 years. Direct symptoms from *Striga* infestations on the host plant include stunted growth, scorching of leaves and wilting, and yellowing of leaves.

4.0 5 Striga control methods.

- Crop rotation with cotton - Crop rotation with cotton they can reduce the *Striga* seeds population in the soil for up to 30% and increase crop yields.
- Hand pulling of *Striga* – uprooting should be done once after flowering of *Striga* in order to prevent production of seeds accumulate in the soil for next season.
- Application of farm yard manure – tend to suppresses germination of *Striga* seeds and increase soil fertility
- Use of resistant or tolerant varieties.
- Inter-cropping cereals with pulses – tend to reduce infestations significantly.
- Use of clear farm implements.

5.0 Dissemination of the IPM technologies

These technologies were disseminated to the farmers through different channels

The IPM working groups

IPMWGS is the group of farmers jointly by extension and IPM project in Shinyanga region. Basically, the IPM WGS, in Shinyanga region were initiated in order to involve the target beneficiaries testing and validating technologies. IPMWGS have been role models in IPM technology implementation, demonstration and disseminate IPM in Shinyanga region.

Existing extension services

Village extension officers, under Ministry of Agriculture and Food Security are the main target for disseminating IPM technologies to farmers.

Other channel of dissemination was through the IPM farmer clusters, and different institutions including-:

- World Vision Tanzania.
- District rural development projects (DRDP).
- Religious institutions i.e. Agricultural program under the Catholic Church the Diocese of Shinyanga.
- Input dealers.
- Care Tanzania.

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Distribution of Striga *Species in Shinyanga Region - Shinyanga Region, Tanzania, Survey 1994*

Factor	Species	Infestation rate
Overall infested fields	Maize	59%
	Sorghum	65%
	Pearl Millet	0%
	Average	**60%**
Highly Infested Fields	Maize	28%
	Sorghum	31%
	Average	**29%**
Striga Species	Striga hermonthica	84%
	Striga asiatica	42%

Paper N
Ilonga crop protection outputs for semi-arid areas of Central Zone

AM Mbwaga, S Mndolwa
ARI Ilonga

J Hella
Sokione University of Agriculture, Morogoro

Activities

1.Survey on diseases and parasitic weed of sorghum in Tanzania: Occurrence and distribution in Tanzania (Mbwaga et. al, 1993)

2.Survey of diseases and parasitic weed of pearl millet in Tanzania: Occurrence and distribution (Mbwaga et. al, 1993)

3.Survey of sorghum smut in Dodoma (see below)

4. Control of Sorghum smut by seed selection from the field

5. Introduction of cassava as an alternative food source for farmers to save selected seed of sorghum during hunger period

6. Incorporation of awareness and control of sorghum smut disease in the school curricula

7. Management of Striga

- Evaluation of Striga resistant sorghum cultivars
-Intercropping of sorghum with groundnuts
-Use of animal manure
-Education of farmers and extension on striga biology and possible control options

SORGHUM SMUT SURVEY 1996 – 2002
20 villages were surveyed

Dodoma District: Chipanga, Mvumi(M), Hombolo(M), Msanga, Mloa(B), Chipanga, Mpalanga, Chiguluka, Chipogolo-fufu

Mpwapwa District: Igoji 1, Igoji 2

Kondoa District: Kidoka, Chemba, Gwandi, Farkwa, Tumbakosa

Findings:

-High knowledge of the issue in some villages e.g. Mangwitili
-Poor knowledge about biology of smut;
-Gender association

Approach:
On-farm research (farmers as researchers) Mphalanga, Mvumi (M), Mlowa(B), Msanga
Drama sessions and other approaches through primary schools

Research plots:
3 varieties Lugugu, Pato and Tegemeo
3 treatments Dawa, Safi, Lundo

Plot layout

Lugugu	**Pato**	**Tegemeo**
Dawa	Dawa	Dawa
Safi	Safi	Safi
Lundo	Lundo	Lundo

-Field score: farmers
-Analysis: farmers
-Production of clean seed for their farm
-School involvement

Cassava:
Seed problems
Cassava as alternative crop
Cassava introduced in participating villages

Conclusion:
Knowledge uptake was achieved by working with farmer groups and through schools. The information spread to other farmers in these ways. Cassava was introduced as alternative crop to support food security.

INADES Formation Tanzania: Crop protection related activities Experiences and Issues in Central Zone

J Kitange and P Lameck
INADES formation Tanzania, Dodoma

Project Origin

At INADES crop protection is included under the Indigenous Knowledge training Programme (IK). The IK project is a direct product of the 1995 Creative workshop organized by IFTz and attended by farmers and partners. One of the ideas that emerged during the workshop was that IFTz should help farmers to develop and use indigenous knowledge. Towards the end of the workshop therefore IFTz identified participant farmers who were interested in IK promotion and they volunteered to be pilot farmers in IK activities in their respective villages. The objectives assigned to this initiative were

- To identify the indigenous knowledge and practices and disseminate them to other farmers for wider use
- To document all verified indigenous knowledge found useful
- To integrate farmers knowledge with scientific knowledge
- To reduce farmers agricultural production costs (crops and livestock)

To launch the IK initiative, IFTz and pilot farmers held a meeting to plan on how to implement the project based on these objectives. The following issues were discussed and agreed upon:

1.Basic activities to be carried out in the IK promotion initiative by farmers

- Identify farmers with IK and collect information from them
- Form IK groups
- Try out or experiment on information collected in order to prove it
- Disseminate the valid IKs for wider use
- Sensitize farmers to make use of IK

2.Basic activities to be carried out by IFTz

- Support the formation of IK groups
- Assist in organizing sensitization and reflection workshops
- Organize the exchange of IK information among farmers from different areas
- Document the verified information in the form of technical notes

Different Strategic steps in the implementation of the project

The first strategic activity was the formation of the IK groups. Pilot farmers assisted by IF, sold the idea to their fellow villagers and encouraged people to join the group. In the beginning people were not willing to join the groups. However as people realized the benefit of using IK, the group size kept increasing.

Other groups supported by IF moved on to collection of information. This was done by farmers interviewing information bearers. Relatives were also used to gather information from people

who were initially reluctant to provide it. As time went by much more information was gathered through exchange workshops/visits. These became more open because those with information began to benefit by receiving IK from others.

After the collection the initial information, we moved on to the experimentation phase. Information sharing sessions were organised. During these session individual participants and IK group secretaries recorded the information presented so that participants could make use of the information in the future. The experimentation was carried out by farmers on a voluntary basis. Results obtained (positive or negative) were reported to the group secretary for recording and were also shared in IK group meetings.

When information has been tested and certified it is then disseminated. The dissemination of the verified information was done by both farmers and IFTz. Farmers did this through sharing results with their neighbors, non IK groups and networks. IFTz disseminated information through documentation and the sale of the IK techniques notes to farmers, development workers and others. IFTz has also supported farmer exchange visits and workshops.

Results:

- The project now covers four region namely Singida Dodoma, Mororgoro and Mbeya. A total number of 34 villages have been involved. Each has an IK group which is involved in identifying, verifying and disseminating IK information

- Seven technical notes on IK have been produced. These have been widely distributed for use by farmers especially in crop protection, food conservation/storage and animal treatment.

- Gradually farmers are confirming the effectiveness of IK especially in vegetable protection, cereal storage, and human treatment. Some farmer have reported reduction in the cost of production due to use of IK in crop protection and food conservation.

- Most groups keep records of their experiments (trials and results) and document verified information for dissemination

- Over 100 farmers have local handcraft skills have been identified and their skill has been recorded

- We started IK activities with not more than 5 contact villages. The 34 villages reached to date have been at the request of farmers forwarded to IFTz to conduct IK activity in their areas.

Trend:

- Farmers increasingly value their potential including their knowledge skills and resources
- Participation of local authorities in IK intervention is increasing and it is positively contributing to the dissemination process
- Due to increasing economic problems farmers are now opting to innovate local practices as an alternative to tools manufactured by industry in order to save money
- Use of locally available resources is gaining in popularity although it is still at a low level

Challenges:

- Communication among IK group members needs to be improved mainly through holding regular meetings to share
- How can IFTz support distant farmers who are not reached by current project field activities?
- IFTz has to assist farmers to strike a reasonable balance in IK activities i.e., when promoting IKs to pay due attention to all areas of their daily activities ranging from crop and livestock production to human health.

Difficulties/Limitations in IK training program

- There is a need to improve the feedback mechanism within IK groups i.e. to bring about the effective information sharing between representatives of the group who attend sessions and their colleagues so as to speed up the adoption of the results.
- Researcher, professionals and development workers are interested in use of local medicinal plants; there is therefore a risk of farmers knowledge being taken away by learned people for their benefit without rewarding the owners of information the.
- Much IK information is gathered but the pace of verifying the information is limited because the application depends on the needs that arise e.g. problems associated with testing a botanical remedy as a human treatment
- Farmers have taken no measure to publicize what they are doing and their main targeted market is limited to the immediate community in relation to crop protection

Lessons gained:

- Well facilitated farmers are best trainer among themselves
- There abundant IK skills that have never been exploited nor adequately supported by other stake holders
- Controlling elegant grass hopper is still a problem
- Nothing has been done on *Striga*

Technical notes developed by INADES on farmers medicinal plants with their names

1.The use local medicine to treat livestock diseases No 1
2.The use local medicine to treat livestock diseases No 2
3.The use local medicine protect crops in the field No 1
4.The use local medicine protect crops in the field No 2
5. Indigenous technology in grain preservative No 1
6. Indigenous technology in grain preservative No 2

Overview of Crop Protection related activities undertaken by World Vision in semi-arid Central zone

Z.S. Masanyiwa
Program Co-ordinator Mpuguzi ADPP

1. Introduction:

World Vision Tanzania – Central Zone operates in 3 regions namely Dodoma Singida and Morogoro. Currently there are 11 ADPs i.e.

-Sanzawa, Kwamtoro and Farkwa ADPs – Kondoa District
-Mpunguzi, Chipanga and Mundemu ADPs Dodoma Rural District
-Mpwapwa ADP – Mpwapwa District
-Kinyangiri, Kinampanda and Kisiriri ADPs – Iramba District
-Magole ADP – Kilosa District

Total target population is about 420,000 people. Interventions being implemented target Agriculture/Livestock and food security, primary health, education, economic development, Environmental protection, advocacy and water development.

2. Crop protection activities

- Training of contact farmers, village agricultural facilitators and farmers on improved agronomic practices including primary tillage (Oxenisation) proper use of herbicides, use of improved storage granaries to reduce post harvest losses.

- Provision of farm implements such as ox-plow, ox carts, sprayer pumps, pedal pumps etc.

- Promotion and provision of improved seed for draught resistant crop such as sorghum, cassava, millet, groundnuts and peas

- Promotion of local herbs e.g. 'mhafa' and 'Marobaini' (Neem)

3. Challenges:

- Lack of technical expertise in use of herbicides for most farmers
- Poor cereal storage facilities leading to post harvest losses
- Pest resistance to herbicides

Farmer field schools (FFS) in Kondoa district

E.P. Malanga
District Extension Office, Kondoa

A. ESTABLISHMENT OF FFS

In 2001/02 season 5 schools were established in 5 villages so that 25 farmers per village were involved.

B. OBJECTIVES:

To train farmers in better agriculture practices by using the FFS approach

C. Implementation

- Farmers selected themselves after village meetings which introduced FFS
- Selected farmers chose a 1 acre plot for FFS, and they built a hut for theory sessions

The chosen field, planted to maize, was divided into 4 sub-plots each 0.25 of an acre, and each sub-plot had its activity as follows:

1. Recommended agronomic practices including fertilizers and pesticides
2. Recommended agronomic practices without fertilizers and pesticides
3. Traditional agronomic practices with fertilizers and pesticides
4. Traditional agronomic practices without fertilizers and pesticides

In sub-plots 1 and 3 IPM was implemented. The day to day performance of the crop was monitored and recorded including plant growth, diseases and pests. In sub-plot 2 only planting and weeding was done. Together with practical training farmers had a theory session once a week starting from the beginning of the season.

RESULTS

Yield obtained

Plot	yield kg/plot
1	410
2	212
3	105
4	97

Farmers appreciated the results and during the field days many more farmers agreed to use the technology demonstrated in sub-plot 1. Participating farmers are now conducting FFS to educate other farmers in their respective villages.

For the 2002/03 cropping season 20 FFS have been established in 20 villages in the district. Project expectations are to disseminate the technology rapidly so that participating villages can improve maize production.

Paper R

The role of the Area Development Program in Promotion of Improving Production of Appropriate Drought Resistant Food and Cash Crops in Central Zone

Rev A. Senyagwa
Diocese of Central Tanganyika (Development Services Company), Dodoma

Introduction:

There are 9 areas or development divisions in which DCT/DSC works. These area-based programs (ADPs) are each working in 4-8 village so that a total of 54 villages are involved. The approach is integrated in nature but Agriculture/Livestock production is given priority in all programs. The role of ADP is to facilitate its target (small scale farmers) to increase production by use of all modern practices

Total coverage:

Division	**No of Villages**
Mvumi	13
Mwitikira	6
Chilonwa	8
Hombolo	6
Itiso	8
Zuzu	4
Mundemu	4
Chemba	4
Chipanga	5
Bahi	6
Total	**68**

Activities related to agriculture:

In all ADP Programs, priority is given to food security, agriculture (and to a good extent livestock zero grazing). Food security-based production starts from seed preparation and ends with both protecting the seed and food grain from pest attack.

Seed production:

The use of improved seed that can withstand the variable marginal, weather condition of the zone has been a priority. Sorghum (Pato and Macia) have been promoted along with pearl millet (Shibe ,Okoa). Farmers know the good characteristics of these. On-farm seed production using groups and ADP demonstrations have been undertaken since 1995 and there is now an established system of seed multiplication from foundation seed right through to harvest.

Seed processing:

Most of the seed producers involved with DCT have been passing (selling or exchange) seed to neighbors or selling to intermediary NGOs that later distribute the seed free of charge. The quality of seed treatment undertaken by various producers has been of variable quality. DCT/DSC has therefore initiated co-operation with ICRISAT to establish a small seed-processing unit that

dresses seed (TOSCA tested) with fungicide to the recommended level. The seed is then packed in 1 and 2 kg packs for easier distribution. The ADPs also assist farmers by providing seed loans.

Field crop protection:

When a farmer receives seed bought on cash or credit it is his responsibility to protect the crop from pests. ADP usually offers training to the farmers during pest outbreaks. They assist by provision of sprayers and chemicals (but this is limited). We expect other organizations to intervene, but normally ADPs co-operate with Extension workers.

ADPs under DCT/DSC have also been assisted by ICRISAT which has stationed its scientific officer within the company system. ICRISAT has been running short courses in crop protection both for ADP selected schools, and extension workers in Dodoma, especially to focus on the newly introduced short sorghum variety Macia and early maturing maize and pigeon pea. ICRISAT also provide spray pumps and chemicals to every ADP to protect pigeon pea. This crop is useful for suppression of *Striga*.

There has been an intervention, on a pilot basis in 8 villages (4 Kikombo and 4 Zuzu) by a NAEPII funded project working with eligible suppliers of seed and agro-chemicals. These are given a cash loan for input purchases and they sell inputs to farmers for cash or loan. This has contributed to improved availability of seed and crop protection inputs.

Food grain protection:

After harvest, early maturing varieties have been found to prone to storage pests. Therefore part of strategy of ADP is to promote all protection methods both cultural and chemical. The Larger grain borer has been hard to control and both methods failed. Cultural methods fail if the attack has started in the granary and chemicals fail when farmers use fake products and the wrong mixture or dilutions.

Summary:

DTC/DSC has been co-operating with farmers in over 60 villages in Dodoma in improving agriculture production. Over the years the emphasis has been on planting recommended drought resistant and protected seed and on protecting the crop in the field to improve food grain production. The organisations which have assisted our company technically and financially include ADP donors, ICRISAT, NAEPII.

Activities of Plant Health Services in semi-arid areas of Central Zone

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Plant Health Services P.O.Box.1101-Dodoma

1. Introduction

Plant Health services is a division within the Directorate of Crop Development in the Ministry of Agriculture and Food Security. The primary responsibility of the PHS is to execute the plant protection regulatory activities as addressed by the Plant Protection Act of 1997. Part of the duties of the service are carried out by the team of appointed inspectors in the Plant Quarantine and Phtosanitary services stationed at border posts and other entry points. Other activities of the division include the control of migrant pests, control and containment of outbreak pests as will be declared by the Plant Protection advisory committee. It is also the duty of the Chief Inspector, PHS to oversea pesticides registration in the country. There exists an Integrated Pest Management programme, which has been operative within two zones. This has already developed packages for farmers utility in the Western and northern zones. The packages are not meant for control of migrant pests but for identified field pests in the areas. PHS also manages two centers; the Bio-control Centre in Kibaha where natural enemies are bred and, the Rodent Control Center in Morogoro.

PHS has its headquarters in Dar es Salaam and has five operational zones, including Central zone. Boundaries of the Central zone differ from those in the Research system; the PHS central zone includes Morogoro region and the two semi-arid regions of Dodoma and Singida. Control operations for migrant pests do not necessarily follow the administration boundaries of the regions; the extent of any infestation will determine the area of control.

2. Migrant Pests in Central Zone

2.1. Quelea birds

Conditions are favorable in Central zone for the breeding of Quelea birds (***Quelea spp***). The grassland steppes provide abundant annual grass seeds for food, stagnant or slow moving water during the rain season, acacia trees which are preferred by the birds for roosting and breeding, and sorghum, millets and paddy production which provides abundant food for the birds. There are traditional breeding sites of the pest in Dodoma region, where quelea birds have been known to breed for many years.

2.2. Armyworm

Armyworm (*Spodoptera exempta*) exist in a solitary phase at the Indian Ocean coast line and other permanent wetlands within the zone. The onset of the rains triggers breeding leading to the dispersal of adults, carried on the wind to Mvomero, Morogoro, Kilosa, Mpwapwa, and Kongwa districts. Further mass breeding occurs at Primary outbreak areas for the pest in Morogoro and Dodoma. Armyworm have been known to cause 100% crop losses on grains in the areas with a uni-modal rainfall regime and semi- arid climate like Dodoma.

2.3. Locusts

The Wembere flats in Singida region and Bahi plains in Dodoma are established breeding areas of the Red Locust (*Nomadacris septemfasciata*). Swarms escaping control operations on the plains can cause enormous crop damage to the neighboring districts.

2.4. Outbreak pests

A number of "declared outbreak pests" are present in the zone.

2.4.1. Cassava mealy bug *Phenacoccus manihoti.*

Cassava mealy bug infestations were first reported in Dodoma in 1987 although few farmers were interested in producing cassava at the time. For the last four years Dodoma regional authorities have been promoting the production of cassava as an alternative food crop. Cassava cuttings have been sought from different regions including Pwani, Morogoro and Tabora. However, as these planting materials were infested with the pest, this move combined with the length of the dry season in the area has contributed to an increase to the population of cassava mealy bug in the region.

2.4.2. The larger grain borer. *Prostephanus truncantus.*

Following an initial reports of the larger grain borer in Tabora in the early 80's, the pest was found in Kilosa district, particularly the villages around Ilonga research center. All districts in the three regions of central zone are now heavily infested. Several activities have been carried out either to reduce the populations or to manage the pest in farm granaries.

3. Routine control strategies

3.1 Surveys and monitoring

Routine annual surveillance of Quelea is carried out every season throughout the zone. Monitoring of the birds migration, rainfall records and maturity of grass seeds are the factors considered to be helpful in predicting quelea migration. This is complimented by monitoring the rain font and reports from stakeholders.

Catches of *S. exempta* from pheromone traps, rainfall forecasts and wind movements are components of an armyworm forecasting system. Vulnerable districts, and other agricultural centers receive weekly armyworm forecasts throughout the rainy season from the forecasting center at Tengeru in Arusha region.

Growth and development of red locust grasshoppers is monitored at the breeding sites. The international Red Locust Control organisation for Central and Southern Africa (IRLCO-CSA) and the PHS share this responsibility.

4.0 Control

The nature of migrant pests outbreaks; the enormous populations and the losses they can cause at a short notice, requires prompt control measures. Application of pesticides by manual or aerial application methods has been the most convenient and rapid control method for these pests. The semi-arid weather conditions of the area where water is always a scarce commodity, forced scientists to focus on oil based formulations of pesticides (ULTRA LOW VOLUME

FORMULATIONS) for control operations. Hand held ULV applicators are commonly used to control armyworms in small farms while ULV Micronair atomisers fitted on the aircraft pesticide tanks are used to control quelea, red locust and sometimes armyworms within the big estates.

Farmers at household level carry out control of the Larger Grain borer. Mass breeding and releases of the biological control agent for cassava mealy bug *(Apoanagyrus lopezi)* has been a responsibility of the Kibaha Bio-control Center.

5.0. Output programmes existing in the Central zone

5.1. Extension of the IPM control strategies to more zones.

It was emphasised in the budgetary speech by the Minister of Agriculture and Food Security that IPM packages that have been developed by the Northern and The Western zone, should be disseminated to relevant areas in other zones. Through a participatory approach with farmers, pest control needs will be identified in these zones and more packages developed tailored to their crops, environment and priorities. Dodoma and Singida share a lot of common field pests and crops with Shinyanga. Introduction of developed packages on cotton, sweet potatoes and paddy will be achieved through farmers field schools if need arises.

5.2. Field trials on application of Diatomaceous earth as a post harvest pesticide on grain.

Diatomaceous earth is one of the promising post harvest treatments against storage pests. A few products have been registered for use in some countries. In collaboration with NRI, field trials have been established at different locations in the country. These on-farm trials utilise the normal storage facilities for bagged grain. One of the districts involved is Kongwa where there are four sites for testing post harvest treatments.

Treatments on trial are:

- PTOECT-– IT a diatomaceous earth mixed at 100 gm for 100 kg of maize grain (A)
- PTOECT – IT mixed at 250gm for 100 kg of maize grain (B)
- PTOECT – IT mixed at 100gmfor 100 kg of maize and permethrin 2%a.i. mixed at 10 gm for 100kg of maize grain. (C)
- ACTELLIC SUPER DUST mixed at 100 gm for 90 kg of maize grain.(D)
- ANIMAL DUNG ASH mixed at 1.5 kg for 100 kg of un-winnowed maize grain. (E)
- UNTREATED MAIZE GRAIN 100 KG. (F)

Sampling has been carried out after every 8 weeks for 40 weeks during the storage season 2002/3.

5.3. Community based armyworm-forecasting system.

Several trap operators in the country have undergone training on identification of *S. exempta* moths in the pheromone traps of supplied by PHS. The aim of the project being established between the MAFS and NRI is to place traps at ward level so that farmers can forecast the armyworm outbreaks. This will enable farmers to be ready for any infestation. A pilot area has been earmarked in Kilosa district.

5.4. Trials on application of *Metarhizium anisopliae* var.acridium against Red Locust.

A natural occurring and cost effective natural locust control product is now a viable alternative to the use of chemical pesticides. It is based on a fungal disease *Metarhizium anisopliae* var.acridium that is deadly to grasshoppers and locusts, but harmless to other organisms. The pathogen was developed by an international research project called LUBILOSA and trade marked "Green Muscle". These are dark green spores suspended in oil suspension.

Field trials were initiated in Zambia and Tanzania under the Sustainable Control of Red Locust in Central and Southern Africa Project, funded by DFID through NRI and CABI. Mount Makulu Research Institute in Zambia and the PHS are collaborators.

In 2002 a trial on hoppers was conducted in IKU/KATAVI Sumbawanga region Tanzania. In 2003 large-scale trials on hopper populations are being conducted at Wembere flats breeding area in the central zone.

5.6. Rearing and release of *Teretriosoma nigrescens* a biological control agent for the larger grain borer *Prostephanus truncantus*.

Under the GTZ-IPM project, there have been releases of the biological control agent in several regions in the country. Recovery traps have revealed no establishments of the beetle for the last two years in the central zone. There have been records of establishment in the Northern zone.

5.7. Entomopathogenic Baculoviruses for control of the African Armyworm, in Tanzania.

MAFS in collaboration with Natural Resources Institute, has been working on a project which aims to develop, demonstrate and promote the use of baculoviruses (Nuclear Polyhedrosis Virus NPV) as alternative insecticide for control of the African armyworm in Tanzania.

The expected outputs of the project include:

- The evaluation of efficacy of the Nuclear Polyhedrosis Virus for control of outbreaks in the country to include, dose rate and formulations.
- Training of key people on the use of NPV for armyworm control.
- Field trials results dissemination.

The project is currently undertaking laboratory trials, and aims to identify natural occurrence of the disease in armyworms in the field. Our role is to report our observations on diseased worms and collect samples whenever possible.

6. Conclusion

Coordination of PHS activities in the central zone requires co-operation with all stakeholders. With scarce resources there should be sharing of activities to achieve the goal. Our farmers will benefit more from the service if they participate willingly. Creation of awareness by district authorities will play a very important role to make them understand the responsibilities and benefits of every activity. The endless efforts and contributions to PHS programmes by the Natural Resources Institute is greatly appreciated. The institute features in almost every part of our fight against pests.