WORKING PAPER

STRIGA RESEARCH ACTIVITIES IN CENTRAL ZONE AND LAKE ZONE OF TANZANIA: EVALUATION OF ON-FARM RESEARCH TRIALS 2000/ 2001 SEASON

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Cover photos (Simon Pierce). Clockwise from top: S.asiatica flower; Farmers from Chipanga village assessing sorghum trial; Heads of sorghum under evaluation by farmers and scientists in Mwagala village; S.hermonthica in sorghum (Lake Zone); Farmers evaluating sorghum in Mwagala village; Participating farmers in Mvumi makulu with recntly introduced medium duration pigeon pea variety in background.

1. INTRODUCTION

On-farm research is being carried out in Central Zone and Lake Zone to develop integrated management options for the control of *Striga asiatica* and *Striga hermonthica* on sorghum. Research activities include evaluation of sorghum germplasm for resistance/ tolerance to Striga, the use of manure and inter-cropping with legumes. Since 1996, these activities have been funded by the DFID Crop Protection Programme and the government of Tanzania. Following an initial three-year project, a second phase (CPP project R7564) started in 2001.

The 2000/2001 season on-farm trials were planted by participating farmers and village extension staff. Participating farmers, extension staff and researchers from ARI Ilonga and ARI Ukiriguru have monitored the trials.. Multi-disciplinary teams carried out an evaluation in Lake Zone between May 10th – 14th and Central Zone between May 17th -21st 2001.

Lake Zone

The team included:

Dr C. Riches	Weed scientist, Natural Resources Institute (NRI)
Dr A. Mbwaga	Crop Protectionist, ARI Ilonga
Mr E. Kapinga	Agronomist, Ukiriguru ARI
Mr J. Hella	Agricultural economist, Sokoine University of Agriculture
Mr R. Lamboll	Socio-economist, NRI
Mr D.S.Msella	District Crops Officer, Misungwi District Extension Office
Dr G. Ley	Soil scientist, ARI Milingano
Dr J. Watling	Plant physiologist, University of Sheffield
Dr S. Pierce.	Plant physiologist, University of Sheffield
Prof M. Press	Plant physiologist, University of Sheffield
Dr. J. Scholes	Plant physiologist, University of Sheffield
Mr Mwakipesile	Extension Officer, Mwagala
Mr Kabilinde	Extension Officer, Iteja

The team visited the two main villages where on-farm Striga research is being carried out, Mwagala and Iteja in Misungwi district. In each village we were joined by extension staff for that community. Two main sets of activities were carried out, one set related to evaluation of the 2000/2001 trials and the other followed-up soil fertility-related issues. Mwagala was visited on May 10th and 12th and Iteja May 13th - 14th. In both villages, individual trials were visited by members of the evaluation team and the participating farmers. At each trial site, the owner of the shamba explained to other farmers what had been done and what he/ she had observed during the season. Then other farmers asked questions or made comments. On the second day separate groups of women and men carried out variety preference ranking exercises and the strengths and weaknesses of the inter-cropping and manure trials were discussed.

Central Zone

The team included:

Dr C. Riches	Weed scientist, Natural Resources Institute (NRI)
Dr A. Mbwaga	Crop Protectionist, ARI Ilonga
Mr J. Hella	Agricultural economist, Sokoine University of Agriculture
Dr S. Mdolwa	Plant breeder, ARI Ilonga
Mr R. Lamboll	Socio-economist, NRI
Mr Semwaiko	District Crops Officer, Dodoma Rural District Extension Office
Dr G. Ley	Soil scientist, ARI Milingano
Dr J. Watling	Plant physiologist, University of Sheffield

Dr S. Pierce. Plant physiologist, University of Sheffield
Mrs Ulomi Extension Officer, Mvumi Makulu
Mr Kibaya Extension Officer, Chipanga

The team visited the two main villages where on-farm Striga research is being carried out, Mvumi Makulu and Chipanga in Dodoma Rural district. In each village the team was joined by the respective extension staff for that village, Mrs Ulomi (Mvumi Makulu) and Mr Kibaya(Chipanga). Two main sets of activities were carried out, one set related to evaluation of the 2000/2001 trials and the other followed-up soil-related issues. This report focuses on the evaluation of trials.

Mvumi Makulu was visited on May 17th-18th and Chipanga May 19th – 20th. In both villages, members of the evaluation team and the participating farmers visited individual trials. At each trial site, the owner of the shamba explained to other farmers what had been done and what he/ she had observed. Then other farmers asked questions or made comments. On the second day, separate groups of women and men carried out a variety preference ranking exercises and (in Chipanga) the strengths and weaknesses of the inter-cropping and manure trials were discussed.

This report draws mainly on the May evaluation and a report prepared by Dr Mbwaga on a previous visit to the trials and discussions with farmers in March. Background information on the villages (including soil fertility and inter-cropping) comes mainly from a RRA[1] carried out under the project in 1997, together with secondary sources. The background and results for the two zones and villages are presented separately in this working document.

[1] Mbwaga, A.M. Lamboll, R. and Riches, C.R. (1998) The *Striga* problem in Dodoma region and the Lake Zone of Tanzania: Analysis of the problem and research priorities. Ilonga ARI/ NRI project report.

2. LAKE ZONE

The Lake Zone comprises Mwanza, Shinyanga, Kagera and Mara regions, but *Striga* project activities have focused on Mwanza, in particular Misungwi district. Lake Zone may be divided into two broad physiographic regions, the Central Plateau and the Western Highlands (Enserink and Kaitaba (1996[2]) based on de Pauw (1983 and 1984)). The farming systems of the Central Plateau (also referred to as Sukumaland) are characterised by cereal-cotton cropping and livestock production systems; maize is the preferred food followed by rice and sorghum; crop-livestock interactions are intensive, with ox-traction for ploughing being particularly important. Manure application systems are not well developed. In the Western Highlands, farming systems are dominated by banana-bean-coffee cropping systems and the livestock component is not well developed. *Striga* is essentially a problem in the cereal systems of Sukumaland.

The two villages involved in the trials are currently in Misungwi district, which was formerly a division in Kwimba district. The role and importance of sorghum and other crops in peoples' livelihoods in the location has changed significantly since 1945 (Meertens et al 1995[3]). In 1945 sorghum and pearl millet were the most important cereals gown in the area (Table 1), but by 1962, pearl millet cultivation had almost disappeared and sorghum acreage had decreased dramatically. Meertens et al (1995) argue that this decline came about because of the expansion in cotton and associated wealth which allowed less reliance on home grown grains. Taste became the main criterion for growing cereals and maize was highly preferred. Cassava also appears to have expanded as a food security crop. The 1991 data refers to Misungwi division, where a high proportion of the land is *mbuga* plain, although to the north lies the Sukuma catena. The heavier soils of the *mbuga* plains are difficult to cultivate and much of this area was only settled after 1945 following wider use of ploughs and tractors. The decline in cassava was associated with cassava mealybug and sorghum cultivation appeared to have increased as a food security crop. Cotton declined and rice has increased in response to the ready market and suitability of the soil. Tomato and vegetable cultivation has also increased, particularly those households closer to Mwanza town.

Table 1 Changes in area cultivated of sorghum and other crops in the location of the Lake Zone *Striga* trials

Year	Location	Population density (people/ km^2)	Average cultivated area (acres/ h.hold)	Area of sorghum / h.hold	Area of maize/ h.hold	Area of cotton/ h.hold	Area of rice/ h.hold	Area of cassava/ h.hold
1945	Old Kwimba district	51	7.7	2.95	0.78	0.85	0.53	0.61+
1962	Usmao chiefdom (Old Kwimba)	52	6.7(8.0*)	0.11	1.43	2.94	0.80	0.5 (1.8*)
1991	Misungwi division	75	7.7	0.9	2.5	1.6	2.2	0.5+

* Includes area under cassava fallow: + cassava and sweet potato

According to Meetens et al (1995) the Wasukuma have long realized the usefulness of manure which was more commonly used in the past. As access to land increased use of manure declined, but with land availability becoming a problem, manure use has again increased and 50% of

[2] Enserink H.J. and Kaitaba E. (1996) Farming Systems Zonation, Lake Zone, Tanzania. Report of a mission commissioned by the Farming Systems Research Programme; Lake Zone Agricultural Research and Training Institute. Ministry of Agriculture, Dept. of Research and Training. Mwanza, Tanzania

[3] Meertens H.C.C. Ndege l.J. and Enserink H.J. (1995) Dynamics in farming systems: Changes in time and space in Sukumaland, Tanzania. Royal Tropical Institute, Amsterdam, The Netherlands.

households in Misungwi were estimated to be using manure in 1990/91. The use of chemical fertilizers -introduced after 1961- declined after 1986 following price increases resulting from national Structural Adjustment Policies. In 1990/ 91, 10% of households were estimated to be using chemical fertilizer, particularly on crops such as tomatoes and maize.

2.1 MWAGALA VILLAGE

2.1.1 The village and the surrounding area

Mwagala is in Ukiriguru ward, Misungwi district and is more or less neighbouring Ukiriguru ARI. The village has a total of about 410 households. It is located in an area which may be broadly categorised as 'Sukuma catena', but dominated by *luseni* soils (Bunyecha et al 1994). The catena runs from the rocky granite hilltops through the upper foot slopes, to the lower foot slopes and then the valley floor (Bunyecha et al 1994[4], Meertens et al, 1995). During an informal survey in 1994 farmers were asked to estimate the percentage of soil types in Mwagala, they reported: *luseni* (60%), *nduha* (10%), *itogolo* (20%), *mbuga* (10%).

2.1.2 *Striga* trials in Mwagala 2000/2001 season

1. Introduction

Following a number of years where the October rains have failed, this year it was possible to plant and harvest trials in the short rains as well as the subsequent long rains season. Eleven participants planted in the short rains and five farmers in the long rains. Problems included the crop being severely attacked by crickets at germination, which caused some farmers to plant at least twice. Three out of the 14 participants were women. (Table 2).

Table 2 Farmers Participating in *Striga* Trials in Mwagala 2000/ 2001

Name of farmer	Sex	Variety trial: P9405, P9406, Pato, SRN39, Macia, Weijita	Variety trial: P9406, P9405, PATO, Local	Intercropping trial-Sorghum with cowpea	Short rains	Long rains
Priska Luguga	F	3♦	3		3	
Joseph Shiyuri	M	3♦			3	
Robert Masasilo	M	3♦		3	3	
Joshua Enos	M			3	3	
Andrew Shelembi	M		3♦		3	
Machibya Khaji	M	3♦			3	
Helen John	F	3♦			3	
Mwagala P. School		3♦			3	
Paul Madaha	M	3♦			3	
Enos Kadikilo	M	3		3	3	3
Jasco Busagara	M	3		3	3	3
Ruth Nyang'hani	F			3		3
Kashija Malinganya	M		3♦			3
Mabula Mpogomi	M		3			3

Note: ♦ = farmers applied animal manure

2. Evaluation of sorghum varieties

Farmers were asked to bring examples of the sorghum varieties and landraces which are grown in Mwagala to the group evaluation meeting. In separate groups, women and men were then asked to name these and any others in the community. Women and men initially identified ten and 11

[4] Bunyecha, K. Bagarama F. Babu A. Budelman A. Enserink H. Kileo R. Makundi P. Roeleveld A. Tamminga K. Wella E. (1994) Kwimba Distict Informal Survey. Tanzania / Netherlands Farming Systems Research Project, Lake Zone, Tanzania.

'types' of sorghum respectively. Both groups reported the same types, but men identified an additional landrace Ngh'olongo and later five further sorghum types[5]. A pair wise ranking exercise was then carried out to provide an initial ranking and reasons for the preferences, which in turn provided farmers' criteria for distinguishing between sorghum types. A second exercise was then carried out, ranking all the types against each of the criteria[6].

Women and men indentified 15 and ten criteria respectively for distinguishing and ranking sorghum types (Table 3). Both women and men gave the following - pre-dominantly pre-harvest - criteria: ability to withstand drought, ability to withstand *Striga*, less easily attacked by birds, early maturity, ease of marketing, high yields/ large heads, less easily attacked by diseases, less easily attacked by pests. 'Better rate of germination' identified by women is likely to reflect the different source of seed (ie trial varieties produced at Ilonga ARI) rather than inherent qualities of the varieties. Higher nutritional value appeared to be associated with red types.

Table 3 Farmers criteria for sorghum variety ranking in Mwagala village

Criteria	Women	Men
Ability to withstand drought	3	3
Ability to withstand *Striga*	3	3
Less easily attacked by birds	3	3+
Matures more quickly	3	3
Higher yields/ Larger heads	3*	3
Less easily attacked by diseases	3	3
Less easily attacked by pests (field)	3	3+
Ease of marketing	3	3
Many grains per head	3	
Better taste	3	
White colour grain and flour		3
Better rate of germination	3	
Smoothness of ugali		3
Suitability of stems for building		3
Larger grain size	3	
More nutritious	3	
Less easily attacked by storage pests	3	

*Given as 2 separate criteria by women; +Birds and pest reported as one criterion by men

Table 4 provides an indicative summary of the various ranking exercises (Tables 5, 6, 7 and 8 show the detailed results). Women and men appear to express a fairly clear preference for more modern varieties with P9406, Macia, P9405 and Pato all ranking highly overall. P9406 was ranked consistently highly with women and men for most criteria, with the exception of susceptibility to disease, perceived nutritional value (women) and suitability of stalks for building (men). Macia was ranked more highly than P9406, P9405 and Pato by both groups in the pair-wise ranking. There were differing perceptions according to farmers' criteria, with men scoring Macia consistently highly, but women ranking it relatively lowly against susceptibility to field pests, birds, *Striga* and also taste. Marketability appears to be a key factor in Macia's popularity.

[5] Later in the discussion in the men's groups five other sorhums types were also identified as being grown in the village: Tengemea (Tegemeo), Kapongo, Bukula, Wilu and Serena.

[6] The men's group used a slightly different system using a point score of 1 (very good) to 5 (very poor) for each type against each criterion.

P9405 was ranked almost exactly the same as P9406 against all criteria by men, but generally lower by women. Pato appears to have scored relatively well in the pair wise ranking (third with women and men), but less well against specific criteria eg susceptibility to birds and diseases. Weijita – a landrace from Mara - was ranked very highly by women due to factors such as drought tolerance, less susceptible to attack by birds and being more nutritious. Mbapa saba landrace was ranked top by men in the pairwise ranking (also ranked very highly for marketability and drought tolerance), although there is some concern that a small number of farmers may have had a particular influence on the group.

Table 4 Overall score for sorghum variety ranking: Women and Men in Mwagala village

	Men			Women			Overall		
	Pair wise	Criteria	Average	Pair wise	Criteria	Average	Pair wise	Criteria	Average
P9406	3	2	2.5	2	1	1.5	2.5	1.5	2
Macia	2	1	1.5	1	5	3	1.5	3	2.25
P9405	3	2	2.5	5	3	4	4	2.5	3.25
Pato	3	5	4	3	7	5	3	6	4.5
Mbapa saba	1	8	4.5	5	8	6.5	3	8	5.5
SRN 39	6	7	6.5	5	6	5.5	5.5	6.5	6
Makulya	9	6	7.5	5	4	4.5	7	5	6
Weijita	10	9	9.5	3	2	2.5	6.5	5.5	6
Mwanagudungu	7	10	8.5	9	9	9	8	9.5	8.75
Miningamela	11	11	11	10	10	10	10.5	10.5	10.5
Mg'holongo	8	4	6	NR	NR	NR	-	-	-

NR = Not reported by farmers

Table 5 Sorghum variety ranking by farmers' criteria - Women in Mwagala Village

Criteria	P5	Gudungu+	SRN39	P6	Muninga*	Mbapa saba	Wengita	Pato	Makulya	Macia
Larger heads	5	7	5	4	10	8	2	1	9	3
Grain is larger	2	9	7	2	10	8	5	4	6	1
Better taste	5	10	4	3	9	2	6	1	7	8
Many grains per head	6	9	6	4	8	3	2	10	1	5
Less easily attacked by field pests	5	9	5	4	10	7	2	1	3	8
Ability to withstand drought	5	7	5	3	9	8	1	10	2	4
Less easily attacked by birds	5	3	6	4	7	9	1	9	1	8
Ability to withstand *Striga*	2	7	6	2	9	5	4	10	1	8
Higher yield	5	9	4	3	10	8	2	1	6	7
Less easily attacked by diseases	9	3	7	6	5	8	2	10	1	4
Better rate of germination	1	8	5	1	9	10	6	3	7	4
Early maturing	1	10	7	1	9	8	4	3	6	5
Ease of marketing	2	9	5	2	10	7	6	4	8	1
More nutritious	8	3	9	7	4	5	2	6	1	10
Less easily attacked by storage pests	1	10	3	4	6	8	7	9	5	2
TOTAL	62	113	84	50	127	104	52	91	65	78
RANK	3	9	6	1	10	8	2	7	4	5

Table 6 Pair-wise ranking of sorghum types - Women in Mwagala Village

	P5	Gudungu+	SRN39	P6	Muninga*	Mbapa saba	Wengita	Pato	Makulya	Macia
P5		P5	P5	P6	P5	P5	Wengita	Pato	Makulia	Macia
Gudungu			SRN39	P6	Gudungu	Mbapa saba	Wengita	pato	Makulia	Macia
SRN39				P6	SRN39	Mbapa saba	SRN39	Pato	SRN39	Macia
P6					P6	P6	P6	P6	P6	Macia
Muninga						Mbapa saba	Wengita	Pato	Makulia	Macia
Mbapa saba							Wengita	Pato	Makulia	Macia
Wengita								Wengita	Wengita	Macia
Pato									Pato	Macia
Makulya										Macia
Masia										
TOTAL	4	1	4	8	0	3	6	6	4	9
RANK	5	9	5	2	10	8	3	3	5	1

* Reported by women as Muninga and by men as Muningamela; + Reported by women as Gudungu and men as Mwangudungu.

Table 6 Sorghum variety ranking by farmers' criteria - Men in Mwagala Village

CRITERIA	PATO	MACIA	P9406	P9405	Waijita	SRN 39	Mwanagudungu	Makulya	Mpabasaba	Mningamela	Ngh'olongo
Larger heads	1	1	2	3	4	3	4	2	3	5	1
Ability to withstand drought	2	1	2	1	4	3	1	3	1	5	1
Ability to withstand *Striga*	3	1	1	1	3	2	5	?	4	3	3
Less easily attacked by birds/pests	5	2	2	2	1	2	1	1	3	1	1
Smooth Ugali	1	1	1	1	1	2	4	2	2	5	1
Whiteness of flour	1	2	2	2	4	2	4	4	3	5	3
Less easily attacked by diseases	4	2	1	1	1	2	4	2	3	5	3
Matures more quickly	2	1	1	1	3	2	2	3	1	4	5
Suitability of stalks for building material	2	4	4	4	2	3	4	2	4	1	1
Ease of marketing	1	2	2	2	3	3	2	4	1	5	2
TOTAL	22	17	18	18	26	24	31	23	25	37	21
RANK	5	1	2	2	9	7	10	6	8	11	4

Score 1=Very good, 2= good, 3=Average, 4= Poor, 5= Very poor

Table 7 Pair-wise ranking of sorghum types - Men in Mwagala Village

	(1) PATO	(2) MACIA	(3) P9406	(4) P9405	(5) Waijita	(6) SRN 39	(7) Mwanagudungu	(8) Makulya	(9) Mpabasaba	(11) Mningamela	(10) Ngh'olongo
PATO		2	1	4	1	1	1	1	9	1	1
MACIA			2	2	2	2	2	2	9	2	2
P9406				3	3	3	3	3	9	3	3
P9405					4	4	4	4	9	4	4
Waijita						6	7	8	9	5	10
SRN39							6	6	9	6	6
Mwanagudungu								7	9	7	7
Makulya									9	8	10
Mbapasaba										9	9
Miningamela											10
Ng'holongo											
TOTAL	7	9	7	7	1	5	4	2	10	0	3
RANK	3	2	3	3	10	6	7	9	1	11	8

3. Inter-cropping evaluation

Inter-cropping of cereals with legumes is a common practice in the Lake Zone. The project is assessing the effectiveness of inter-cropping sorghum with cowpea in order to suppress *Striga*. In the short rains, four farmers participated in this trial and in the long rains one. In separate focus groups, men and women were asked to evaluate the strengths and weaknesses of inter-cropping sorghum with legumes.

Both women and men's groups reported that intercropping with legumes improves soil fertility. Women also reported that it reduces *Striga* and increases crop yield. Men saw other strengths including a reduction in weeds, less workload and as a means of addressing land shortage. Both men and women reported that inter-cropping can impede weeding and that the yield of the main - or cash- crop may be less.

Table 8 Perceptions of strength and weaknesses of intercropping: Women and men in Mwagala village-

	Strengths	Weaknesses
Women	• High crop yield • Increases soil fertility • Reduces *Striga*	• Can fail to weed • Get less yield for cash crop
Men	• Get diversity of crops in one field • Legumes improve fertility of the soil • Reduces workload • Is good if you have land shortage • Can reduce weed infestation	• Yield for main crop decrease due to water and nutrient competition • Weeding is slower because of the many crops

4. Evaluation of use and effects of manure application

Women and men reported that applying manure (*samadi)* reduces *Striga* (men suggested that with long term use of manure *Striga* can be erradicated), increases crop yield and improves plant growth (although this was considered a strength by men, but a possible weakness by women). Women identified increased weeds and weeding as a weakness. Men reported that if rainfall is low, manure application may have either positive or detrimental influence, equipment is needed for transportation and expertise on use of manure is required.

Table 9 Perceptions of strengths and weaknesses of using manure (Samadi) on sorghum: Women and men in Mwagala village

	Strengths	Weaknesses
Women	• Increase soil fertility • Higher crop yield • Reduces *Striga* • Conserves the soil	• If apply in excess plant grow well but do not yield. • Increase weeds • Increased weeding
Men	• Increased crop yield • Reduced *Striga* • With continued application the *Striga* is eradicated • Even if rainfall is low you can still harvest. • It improves plant growth.	• If rainfall is low manure application may affect the crops • Requires equipment for transportation • Requires expertise on using manure

2.2 ITEJA VILLAGE

2.2.1 The village and surrounding area

Iteja village is in Misungwi ward/ division/ district and is situated on the Mwanza-Shinyanga main road, about 20 km south of Ukiriguru ARI. The village has a total of 609 households in nine sub-villages (*vitongoji*). Approximately 14% of the households are headed by women. A survey carried out in 1979 established the area of the village as 4902 hectares and the main soil types as *mbuga* (38.1% of land area), followed by *itogolo* (36.9%), *ibushi* (13%) and *luseni* (11.8%) (Kajiru et al 1996).

2.2.2 *Striga* trials in Iteja 2000/2001 season

1. Introduction

In Iteja, as in Mwagala, it was possible to get results from trials in the short rains as well as the long rains season. In the short rains, 14 participants were involved in the trials. Two farmers planted sorghum/ cowpea inter-cropping trials, but these did not perform well due to poor population of the sorghum plants, resulting from the dry weather. Only one farmer planted in the long rains. Out of the 15 participants three were women (Table 10).

Table 10 Farmers participating in *Striga* Trials in Iteja village

Name of farmer	Sex	Variety trial P9405, P9406,Pato, SRN39, Macia, Weijita	Variety trial: Pato,P9405,P9406, Local	Intercropping trial- Sorghum / cowpea	Short rain	Long rain
M. Mashinyali	F	3			3	
Lucia Mathias	F		3♦0+1/2		3	
Lucia Joseph	F			3	3	
C. Mfungwa	M	3♦			3	
Paul Katamuki	M	3			3	
Nkayaga Kazimili	M	3			3	
Elias Mkula	M	3♦			3	
Ramadhani Mashala	M	3♦			3	
Kamzio Gervas	M	3♦			3	
Kidiga Chandaluba	M		3♦0+1/2		3	
Bunzali Nchemenche	M		3♦0+1/2		3	
Mabule Dotto	M		3♦0+1/2		3	
Gideon Paul	M			3	3	
Primary school	P	3♦+			3	
Samuel Malulu	M	3♦				3

Note: ♦= farmers applied animal manure

2 Evaluation of sorghum varieties

Farmers were asked to bring examples of sorghum, which are grown, in Iteja. In separate groups, women and men were then asked to name the varieties/ landraces and any others, which they knew, existed in the community. Women and men identified ten[7] and 11 'types' of sorghum respectively. The two groups reported nine of the same types, and in addition men identified two additional landraces Ngh'olongo and Kakula. A pair wise ranking exercise was then carried out to provide an initial ranking and reasons for the preferences, which in turn provided farmers' criteria for distinguishing between sorghum types. A second exercise was then carried out, ranking all the types against each of the criteria.

[7] Women intially identied nine types, but later identified Serena variety, but this was not included in the evaluation

Women and men initially identified 13 and nine criteria respectively for distinguishing and ranking sorghum types (Table 11). Both women and men reported the following criteria: ability to withstand drought, less easily attacked by birds, early maturity, ease of marketing, high yields/ large heads, taste, white colour and grain. Ability to withstand *Striga* was reported by men and agreed by women after being introduced by the facilitator.

Table 11 Farmers' criteria for sorghum variety ranking in Iteja village

Criteria	Women	Men
Ability to withstand drought	3	3
Less easily attacked by birds	3	3
Quicker maturity	3	3
Ease of marketing	3	3
Higher yields/ Larger heads	3	3
Better taste	3	3
White colour grain and flour	3	3
Ability to withstand Striga	*3	3
Less easily attacked by diseases	3	
Less easily attacked by pests (field)	3	
Better rate of germination	3	
Less easily attacked by store pests		3
Ease of de-hulling	3	
Less weeding frequency	3	
Ease of threshing	3	

*Introduced by facilitators

Table 12 provides an indicative summary of the various ranking exercises (Tables 13, 14, 15 and 16 show the detailed results). Even more than in Mwagala, farmers expressed a clear preference for modern varieties with women and men ranking Macia, P9405, Pato and P9406 in the top four by both methods of evaluation. Macia scored consistently highly (particularly with women), with the exception of susceptibility to bird attack (women and men). P9405 was generally ranked slightly higher than P9406 against almost all criteria, by women and men. Pato was ranked first in terms of marketability by women and men. None of the landraces scored well overall, although some such as Mwanagudungu and Weijita scored well against a small number of criteria such as being less susceptible to bird attack and ease of de-hulling.

Table 12 Overall score for sorghum variety ranking: Women and Men in Iteja village

	Men			Women			Overall		
	Pairwise	Criteria	Average	Pair wise	Criteria	Average	Pair wise	Criteria	Average
Macia	2	3	2.5	1	1	1	1.5	2	1.75
P5	3	1	2	2	2	2	2.5	1.5	2
Pato	1	4	2.5	4	4	4	2.5	4	3.25
P6	4	2	3	4	3	3.5	4	2.5	3.25
SRN39	5	5	5	6	6	6	5.5	5.5	5.5
Tegemeo	6	9	7.7	2	5	3.5	4	7	5.5
Mwanagudungu	7	6	6.5	7	7	7	7	6.5	6.75
Mbapa saba	8	8	8	8	9	8.5	9	8.5	8.25
Weijita	10	10	10	9	8	8.5	9.5	9	9.25
Kakula	11	7	9	NR	NR	NR	NR	NR	NR
Ng'holongo	9	8	8.5	NR	NR	NR	NR	NR	NR

NR = Not reported

Table 13 Sorghum variety ranking by farmers' criteria - Women in Iteja Village

CRITERIA	Pato	Weijita	P6	P5	Macia	SRN39	Mwanagu dungu	Tege meo	Mbapa saba
Ease of dehulling	1	3	NK	NK	NK	3	3	2	3
Good taste	3	7	5	2	1	6	8	4	9
Ability to withstand drought	7	9	3	2	1	4	5	6	8
Larger head/high yield	4	6	3	2	1	5	8	7	9
Germinate faster	4	8	3	2	1	6	7	5	9
Quickly maturing	5	9	3	2	1	4	8	6	7
Ability to withstand diseases/pest	7	9	3	2	1	4	6	5	8
Ability to withstand *Striga**	5	9	3	2	1	4	6	7	8
Ease of marketing	1	8	5	4	3	9	6	2	7
Shortness of cooking time**	7	9	3	2	1	5	8	4	6
Whiteness of sorghum grains	3	9	5	4	2	6	7	1	8
Less weeding frequency (maturity)	8	9	1	1	1	1	7	5	8
Not easily attacked by birds	7	1	4	5	6	3	1	8	9
Ease of threshing	1	2	6	5	3	9	8	4	6
TOTAL	62	95	47	35	23	66	85	64	99
RANK	4	8	3	2	1	6	7	5	9

* Introduced by facilitators;**Probably refers to cooking of kande (Mixture of sorghum and beans or cowpeas); NK = Not known

Table 14 Pair-wise ranking of sorghum types – Women in Iteja Village

	Pato	Weijita	P6	P5	Macia	SRN39	Mwagudungu	Tegemeo	Mbapa saba
Pato		Pato	P6	P5	Macia	Pato	Pato	Pate	Pato
Weijita			P6	P5	Macia	SRN39	Mwagudungu	Tegemeo	Mbapa saba
P6				P5	Macia	P6	P6	Tegemeo	P6
P5					Macia	P5	P5	Tegemeo	P5
Macia						Macia	Macia	Macia	Macia
SRN39							SRN39	Tegemeo	SRN39
Mwangudungu								Tegemeo	Managudungu
Tegemeo									Tegemeo
Mbapa saba									
TOTAL	5	0	5	6	8	3	2	6	1
RANK	4	9	4	2	1	6	7	2	8

Table 15 Sorghum variety ranking by farmers' criteria – Men in Iteja Village

CRITERIA	Kakula	Tegemeo	P9405	Weijita	SRN39	Mbapa saba	Ng'holongo	P6	Pato	Ngudungu	Macia
Early maturity	2	6	7	10	9	1	11	8	3	4	5
Ease of marketing	11	4	2	10	5	7	8	3	1	9	6
Ability to withstand *Striga*	5	9	1	8	4	6	10	2	11	7	3
High yielding	11	9	2	8	5	10	7	3	1	6	4
Not easily attacked by storage pests	6	8	2	10	5	11	7	3	1	9	4
Ability to withstand drought	6	9	2	10	7	8	1	3	11	5	4
White colour (grain & flour)	11	6	5	9	2	8	7	4	3	10	1
Not easily attacked by birds	1	10	4	2	9	6	7	5	11	3	8
Good taste	11	6	3	10	5	8	7	4	1	9	2
TOTAL SCORE	64	67	28	77	51	65	65	35	43	62	37
RANK	7	9	1	10	5	8	8	2	4	6	3

Table 16 Pair-wise ranking of sorghum types - Men in Iteja Village

	(1) KAKULA	(2) TEGEMEO	(3) P9405	(4) WEIJITA	(5) MBAPA SABA	(6) SRN 39	(7) MASIA	(8) NGUDUNGU	(9) PATO	(10) P6	(11) NGH'OLONGO
KAKULA		2	3	4	5	6	7	8	9	10	11
TEGEMEO			3	2	2	6	7	2	9	10	2
P9405				3	3	3	7	3	9	3	3
WEIJITA					5	6	7	8	9	10	11
MBAPA SABA						6	7	8	9	10	5
SRN39							7	6	9	10	6
MACIA								7	9	7	7
NGUDUNGU									9	10	8
PATO										9	9
P6											10
NGH'OLONGO											
TOTAL SCORE	0	5	8	1	3	6	9	4	10	7	2
RANK	11	6	3	10	8	5	2	7	1	4	9

3 Inter-cropping evaluation

In the short rains, two farmers participated in this trial, but in the long rains there were none. In separate focus groups men and women were asked to evaluate the strengths and weaknesses of inter-cropping sorghum with legumes.

Both women and men's groups reported that intercropping reduces the workload. Men saw other strengths including a reduction in *Striga*, improvment in soil fertility and reported that intercropping is a means of addressing land shortage. Both men and women reported that inter-cropping can reduce yield of individual crops, presumably due to competition. Women reported that pests and *Striga* may be increased. Men reported a need for more knowledge and the difficulty of managing crops with different management requirements.

Table 17 Perceptions of strengths and weaknesses of intercropping sorghum with legumes: women and men in Iteja village

	STRENGTHS	WEAKNESSES
Women	• Reduces the work load • All food crops matures together	• Reduces groundnuts yields • Increases *Striga* (both orange and purple types)when you plant sorghum with cowpeas • If intercrop cowpeas and cassava , cassava is affected • Pest incidence increases
Men	• You get more variety of crops in one shamba (plot). • Inter-cropping with legumes reduces *Striga* • Intercropping reduces the workload • Growing legumes make soil more fertile • Many different crops can still be produced even in a situation of land scarcity.	• The yield of the target crop is reduced • It is difficult to manage when crops needs different management requirements • Insufficient knowledge of intercropping options.

4 Evaluation of use and effects of manure application

Women and men reported that applying manure (*samadi)* increases crop yield and improves water holding capacity of the soil. Women also reported that it improves soil fertility and crops grow faster. Men noted that it reduces *Striga* and that it is cheaper than chemical fertilizer. Both groups identified increased weed infestation following manure application as a weakness and that manure can be detrimental to crop growth if rainfall is low. Men (as in Mwagala) reported that equipment is needed for transportation and expertise on use of manure is required.

Table 18 Perceptions of strength and weaknesses of using manure on sorghum; Women and Men Iteja village

	STRENGTHS	WEAKNESSES
Women	• Increases crop yields • Crops grows faster • Increase soil fertility • Improves soil water holding capacity	• Increases weeds • Increases weeding • If rainfall is not enough, it can make soil even drier
Men	• Increase in yield when use FYM • Reduction of *Striga* • Increases water holding capacity of the soil so can harvest even when rain is low • Cheaper compared to chemical fertilizers.	• When rainfall is low, crop is adversely affected • You need appropriate tools for transportation • Don't have enough knowledge of the properties of nutrients in FYM • Increases weeds

2.3 Summary of main points- Mwagala and Iteja villages, Misungwi district

The research environment- the general rainfall pattern is bimodal with most rain falling from November to December and from March to April. Potentially, planting may take place with the short rains and/ or the long rains. However, the rains are highly unpredicable and heavy, localized rainstorms separated by dry spells is a common pattern. Annual rainfall data from Ukiriguru from 1940-1990 varied from as low as 530 mm per year to as high as 1,479 mm per year (Meertens et al 1995). In 2000/ 2001, the project was realtively successful (for the first time) with trials planted in the shorts rains, but not in the long rains.

The research process- the project is working with farmer research groups initiated by Ukiriguru ARI researchers some years ago. The project team has built on this initiative by increasing the involvement of Misungwi district extension staff and encouraging a more active role in trial implementation. Although wealth ranking suggests the project is working with some of the poorer farmers in the two villages, there is still low participation from women (22% of farmers).

Variety evaluation- farmers use a wide range of criteria to characterise and determine their preference for different sorghum types. Five criteria were reported by all groups: ability to withstand drought; less easily attacked by birds; early maturity; higher yields/ Larger heads and ease of marketing. A further five were reported by three groups: less easily attacked by diseases; better taste; white colour grain and flour; less easily attacked by pests(field) and ability to withstand *Striga*.

Overall women and men expressed a strong preference for modern early maturing, high yielding varieties: Macia, P9405, P9406 and Pato. This may reflect maize rather than sorghum being the preferred food (and a major decline in sorghum cultivation between 1945 and early 1960s). The actual sorghum preference varied between villages and groups and combining the results of both evaluations suggests the most preferred variety is Macia for Iteja women and Mwagala men, P9406 for Mwagala women and P9405 for Iteja men. Although the project has made available seed of a range of modern cultivars to farmers for testing since 1997, this was the first year when the rainfall pattern allowed a significant harvest from trial plots. The exercise should be repeated using all criteria next year. It should be noted that these results are from farmer research groups and it is not clear to what extent they reflect the wider community within the village, the district and Lake Zone.

Use and effects of manure-the Wasukuma have long realized the usefulness of manure and the use of manure was more common in the past. As access to land increased use of manure declined, but with land availability becoming a problem, manure use has again increased and 50% of households in Misungwi were estimated to be using manure in 1990/91. All groups reported that the application of manure improves yield and three groups noted that it reduces *Striga*. However, the use of manure is associated with increased weeds and its effect can be detrimental if there is insufficient rainfall. The need for transport to fields and expertise were noted by both groups of men. The project team needs to assess if it is sufficiently building on previous soil fertility work undertaken by Ukiriguru researchers in these villages.

Intercropping cereals with legumes-inter-cropping of cereals with legumes is a common practice in the Lake Zone. Women and men reported that intercropping with legumes improves soil fertility, can reduce the workload and that it reduces *Striga*.. Men in both villages noted that it addressed the issue of land shortage. However, both men and women reported that inter-cropping can impede weeding and that the yield of the main or cash crop may be less. In Iteja, women reported that pests and *Striga* may be increased. Men in the same village reported a need

for more knowledge and the difficulty of managing crops with different management requirements.

The way forward -in a meeting of the project team it was decided that trials involving sorghum lines and manure would continue on *luseni* (sandy) and *mbuga* (heavy) soils. Inter-cropping trials would continue for one more season.

3. CENTRAL ZONE

The Central Zone comprises Dodoma and Singida regions, but *Striga* project activities have focused on Dodoma only, in particular Dodoma Rural district.

3.1 MVUMI MAKULU VILLAGE

3.1.1 Background

Overview of the village and the surrounding area

Mvumi Makulu is located in Mvumi division, about 40 km south-east of Dodoma town. Mvumi division has a population density of 76 people/ km^2 and the west of the division (where Mvumi Makulu is located) 117 people/km^2. According to Holtland[8] (1994) there has been high population pressure in this area for over one hundred years. An associated feature, is the high level of out-migration (both temporary and permanent), particularly of economically active men. The people are mainly Wagogo and have been described as cultivating pastoralists. Traditionally livestock (rather than land) formed the basis of inherited property. In 1986, the HADO (Hifadhi Ardhi Dodoma) programme implemented a de-stocking programme in response to the high level of soil erosion which was associated with cattle numbers in the division. At this time, the proportion of households owning cattle had already declined to about 15%. All cattle within the division are now officially zero-grazed. Pearl millet and sorghum are the main staple crops of the area.

Soil fertility and the use of manure

Improving soil fertility can help to control the negative effects of *Striga*. To varying degrees farmers in Mvumi Makulu know that animal manure, fallowing and rotation improve fertility (crop yield). However, manure is in short supply, it is expensive and for most the only option for transporting to fields is in baskets on their head. Prior to de-stocking, 19% of households applied manure. In 1997-a survey of 28 households in two villages in Mvumi division reported 9% of households applying ash, 6% organic manure and 3% chemical fertilizer (Mhina[9] 1997). Land is scarce and rarely left completely fallow (12% according to one survey-Holtland 1994). Uncultivated land may reflect labour shortage, rather than deliberate fallowing. Some farmers rotate cereals with legumes where soil is suitable eg bambara nuts after millet. Sorghum and millet are typically dry planted, with farmers using a zero-tillage system.

Very few cattle are kept in the village and there is, therefore, a lack of animal manure. Land scarcity makes green manure fallow unfeasible (Holtland 1994). Relay planting of green manure species into cereals may be an option, but this would be an opportunist strategy, only possible in seasons with well distributed rainfall. Labour may be scarce, particularly in poorer households. Credit is not available for chemical fertilizer, but the returns are also questionable, particularly in such a semi-arid environment.

Soil infertility appears to be perceived as a problem by at least some farmers and therefore there is a perceived need to address the problem. Some farmers, at least, are familiar with benefits of chemical fertilizers. Holtland suggests CAN may be an option depending on the price of the fertilizer and the sorghum market. The project is exploring the options for very specific applications (0, 0.25 kg and 0.5 kg per hill) of animal manure as a means of suppressing *Striga* and increasing sorghum yield.

[8] Holtland G. (1994) A farming systems analysis of Mvumi division, Dodoma region, Tanzania: A case study of intensifying agriculture in semi-arid Africa. Mvumi Rural Training Centre, Dodoma.
[9] Mhina E.(1997) Report on research findings on PRA and gender analysis in Mvumi division, Dodoma. FAO and Government of Tanzania.

Inter-cropping
Farmers' strategies needs further research. Mixing of crops takes place, but usually on the basis of many minor crops (eg watermelon, calabash, cowpea, pigeon pea) with one or two main cereal crops. Long duration sorghum and millet are dry planted with zero-tillage. Farmers report that groundnuts and bambara nut require more attention and are planted after rains (also maize). Groundnuts (in particular) and bambara tend to be planted separately (as a cash crop). Cowpea may be mixed with sorghum. Pigeon pea is grown in the village by a few farners at very low plant populations and some have expressed an interest in expanding this crop. Some legumes eg groundnuts perform better on sandy soils, whereas sorghum and maize are more commonly found on sandy loams. Inter-cropping cowpea and pigeon pea with sorghum would seem to offer the most potential in terms of consistency with farmers' current practices. However, the parasitic weed *Alectra vogelii* is very common in the village and local cowpea lines appear highly susceptible.

3.1.2 *Striga* Trials in Mvumi Makulu 2000/2001 season

1. Introduction

In Dodoma Rural, major problems affecting the implementation of trials during 2000/2001 season included: outbreaks of army worm after crop emergence and green bugs at grain filling, together with continuous rains which led to water-logging. These affected the crop planted in October/ November 2000. The crop planted in January/ early February suffered from drought. This season 21 farmers (eight women) took part in the *Striga* trials in Mvumi Makulu (Table 19).

Table 19 Farmer participating in *Striga* trials in Mvumi Makulu

Name of farmer	Sex	Participated 1999/2000	Participated 2000/2001	Varieties/ lines –P9405, P9406, Pato, SRN39, Macia	Intercrop sorghum with groundnuts	Intercrop Pato, P9405 with pigeonpea
Jeniva Ndhalila	F	3	3	3		
Rosemary Mabwe	F	3	3		3	
Bangis Mazengo -	M	3	3	3		
Idan Nzogoro -	M	3	3	3		
Simon MbwanE -	M	3	3	3		
David Nzogoro	M	3	3	3	3	
Ezekiel Myeji	M	3	3	3		
John Dabaga,	M	3	3	3		
Charles Malamba,	M	3	3	3	3	
Timatheo Nyakwarea	F	3				
Ollipa Mazengo	F		3	3	3	
Judith Chiute	F		3		3	
Grace Nyakwake	F		3	3		
Mary Mabichi	F		3	3		
Elizabeth Mahajile	F		3	3		
Ester Chiute	F		3	3		
Hadson Bwagule	M		3	3		
Ernest Sugule	M		3	3		
Stanley Sacrasi	M		3	3	3	3
Yohana Nhibu	M?		3	3	3	3
Wilson Mahajile	M		3	?! !		
Richard Nyamweji	M		3	?! !		

Trials were set up according to researchers' design following discussions with farmers about the treatments they wished to evaluate. Some additional seed was also provided. Monitoring of the trials and data collection was carried out by the village extension staff, together with some visits from more senior extension staff and researchers.

2. Evaluation of Sorghum varieties

Over the past two seasons separate groups of women and men have carried out a ranking exercise based on their own criteria for evaluating sorghum. This year, at the beginning of the exercise participants were asked if they preferred to split into separate women and men's groups, but the majority voted they would prefer to stay together. Participants had been asked to bring samples of sorghum heads with them and nine types were brought. Three landraces identified by farmers in previous evaluations were not brought –N'gonje, Udo and Ndagumo. Macia was not mentioned by this group of farmers in either a positive or negative contxt and the reasons for this are not entirely clear. Prior to ranking by criteria -using all the criteria identified during previous evaluations in Mvumi Makulu - the group was asked to put the criteria into three categories: very important (higher), important (medium), less important (lower). The group was unable to rank all the varieties against two of the less important criteria -tillering and suitability for local brew- so these two are omitted from the total for all criteria (Table 22).

On the basis of the pair wise evaluation, the most preferred types were the modern varieties ranked as follows: P9406, Pato, P9405 and Tegemeo (Table 21). There appears to have been a clear preference for P9406 over P9405 (13 farmers preferred P9406, none preferred P9405 and two abstained) on the basis of having larger seed, larger head, (greater) drought tolerance and *inachanua haraka* flowers/ tassels? more quickly. The preference for P9406 over Pato was less clear cut (10 farmers for P9406 against 5 for Pato) and reasons given included: high yield, little *pumba* (husk/ chaff), shorter plant, large seed, drought tolerant, suitability under any rainfall conditions. This compares to ranking using criteria, where the preference was: Lugugu wa Arusha, Lugugu (local) and Pato and then P9406[10] (Table 22). Lugugu and Lugugu wa Arusha were ranked highly against ease of marketing, taste of *ugali*, whiteness of *ugali*, less *pumba*, less easily attacked by storage pests and stronger stems. When asked to provide an overall ranking, the group found it difficult to reach consensus, but the result is shown in Table 20, together with a combined ranking based on the two evaluations. This suggests a ranking as follows: Pato, P9406, P9405 and then Lugugu wa Arusha.

Table 20 Overall score for sorghum variety ranking women and men in Mvumi Makulu

	Pairwise evaluation	Criteria evaluation	Combined	Farmers' overall ranking
Pato	2	2	2	1
P9406	1	4	2.5	2
Lugugu wa Arusha	6	1	3.5	4
P9405	3	5	4	2
Lugugu	9	2	5.5	9
Sandala	5	6	5.5	6
Bangala	6	6	6	8
Tegemeo	4	9	6.5	5
Mhuputa	6	8	7	7

.

[10] Farmers were unable to rank some of the varieties against 'tillering' and suitability for local brew. If it is assumed that these are all ranked ranked equally low, the preference against all criteria changes slightly as follows: 1-Lugugu wa Arusha, 2-Pato, 3-Lugugu, 4-P9406, 5-P9505, 6-Mhuputa, 7-Sandala and Bangala, 9- Tegemeo.

Table 21 Pairwise ranking of sorghum varieties in Mvumi Makulu - Men and Women

	Tegemeo	Mhuputa	Sandala	Pato	Lugugu	P6	P5	Lugugu wa Arusha	Bangala
Tegemeo		**Tegemeo**=10* Mhuputa=5 NR=4	**Tegemeo**=12 Sandala =7	**Pato**=19 Tegemeo=0	**Tegemeo**=17 Lugugu=0 NR-2	**P6**=17 Tegemeo=2	**P5**=17 Tegemeo=1	**Tegemeo**=15 Lug. wa Arusha=2	**Tegemeo**=18 Bangala=0
Mhuputa			**Sandala**=18 Mhuputa=0	**Pato**=18 Mhuputa=0	**Mhuputa**=16 Lugugu=0	**P6**=18 Mhuputa=0	**P5**=18 Mhuputa=0	**Lu. wa Arusha**=7 Mhuputa=8 NR =1	**Bangala**=11 Mhuputa=6
Sandala				**Pato**=17 Sandala=0	**Sandala**=17 Lugugu=0	**P6**=16 Sandala=0	**P5**=14 Sandala=2	**Sandala**=17 Lug. wa Arusha= 0	**Sandala**=16 Bangala=0
Pato					**Pato**=17 Lugugu=0	**P6**=10 Pato=5	**Pato**=11 P5=6	**Pato**=17 Lug. wa Arusha =0	**Pato**=17 Bangala=0
Lugugu						**P6**=18 Lugugu=0	**P5**=18 Lugugu=0	**Lug wa Arusha**=11 Lugugu=?	**Bangala**=16 Lug wa Arusha=1
P6							**P6**=13 P5=0 NR=2	**P6**=15 Lug wa Arusha=0	**P6**=16 Bangala=1
P5								**P5**=15 Lug wa Arusha=0	**P5**=16 Bangala=0
Lugugu wa Arusha									**Lug wa Arusha**=11 Bangala=0
Bangala									
Total	5	2	4	7	0	8	6	2	2
Rank	4	6	5	2	9	1	3	6	6

***** Numbers refer to number of farmers in meeting voting for a particular type of sorghum

Table 22 Sorghum variety preference by farmers' criteria: men and women in Mvumi Makulu

	Criteria	Tegemeo	Mhuputa	Sandala	Pato	Lugugu	P6	P5	Lugugu wa Arusha	Bangala
H*	High yielding	4	8	5	1	9	2	3	6	7
H	Ability to withstand drought	4	7	5	3	9	1	1	6	8
H	Ability to withstand *Striga*	4	9	5	3	8	2	1	6	7
H	Shortness of plant	3	7	5	4	9	2	1	6	8
H	Ease of marketing	9	6	3	5	1	6	5	2	4
H	Not easily attacked by birds	6	3	5	7	2	8	9	4	1
H	Not easily attacked by field pests	6	2	5	9	1	7	8	4	3
H	Not easily shattering	4	9	5	3	8	2	1	6	7
H	Not easily attacked by store pests	9	2	6	5	1	7	8	3	4
H	Good tasting ugali	9	3	7	8	1	6	5	2	4
M	Strong stem	9	6	2	1	4	8	8	3	5
M	Large head	6	9	8	1	4	2	3	5	7
M	Large grain	7	9	6	1	8	4	5	3	2
M	Easily de-hulled	9	2	5	6	3	7	8	4	1
M	Whiteness of ugali	5	1	4	8	3	6	6	2	9
L	Less husk	9	1	5	8	2	6	6	3	4
L	Tillering	5	1	NK	4	NK	2	2	NK	NK
L	Suitability for local brew	NK	1	NK	3	2	NK	NK	NK	NK
Total	Very important	58	56	51	48	49	43	42	45	53
	Very important and important	94	83	76	65	71	70	72	62	77
	All criteria	103	84	81	73	73	76	78	65	81
Rank	Very important	9	8	6	4	5	2	1	3	7
	Very important and important	9	8	6	2	4	3	5	1	7
	All criteria	9	8	6	2	2	4	5	1	6

*Perceptions of importance: H =Higher; M=Medium; L=Lower.
NK = Not known

3. Inter-cropping evaluation
The project is assessing the effectiveness of a groundnut/sorghum inter-crop as a means of suppressing *Striga.* In the 2000/ 2001 season seven farmers participated in this trial.

Pigeonpea and Marejea

Five? farmers planted pigeon pea. This was the first time that participating farmers had access to modern cultivars with medium maturity. Farmers also were given sufficient seed to plant blocks of pigeon pea which are not usually seen in the village. In general farmers plant a few scattered plants if the crop is grown at all. It had also been planned to evaluate *Marajea* (Crotalaria) as a green manure. It had been decided that the village extension worker would plant a demonstration plot only this season. This however made little growth due to drought after the crop was established. A number of strengths of pigeon pea cultivation were identified including: its suitability as a source of cash, source of relish/ it can be harvested fresh or dry, improves soil fertility, drought tolerance, suitability for firewood and it can be intercropped with other crops. The main weaknesses were its susceptibility to pests in the field and in storage.

Table 23 Farmers perceptions of strengths and weaknesses of cultivating pigeon pea: Mvumi Makulu (men and women)

Strengths	Weaknesses
• Provides a relish both when fresh and dry (in the dry season) *I* • Cash crop • The fallen leaves improve soil fertility • The stem, roots etc can be used as fuel • It's easy to inter-crop with other crops • You can harvest two times? • Drought tolerant • Medicine for stomach problems (*Dawa ya degedege na kuharisha)*	• Susceptible to field pests • Susceptible to storage pests

4. Evaluation of use and effects of manure application
This season no farmers participated in this trial due to a shortage of manure.

3.2 CHIPANGA VILLAGE

3.2.1 Background

The village and surrounding area
The people of Chipanga are Wagogo, although they consider themselves different from the Wagogo of Mvumi Makulu. There is a lower population density than Mvumi division (Dodoma Rural (without Mvumi): 27 persons / km^2 in 1988). Cattle numbers are much higher and they are managed on open pasture, rather than zero grazed. Although land appears to be plentiful in Chipanga, provisional questionnaire survey results suggest the majority of households have access to relatively little land for cultivation (eg an average of 2.4 acres for six of the poorest households surveyed). This is at least partially due to a large protected area adjacent to the nearby lake which can only be cultivated with permission from local government officers Another contributing factor is likely to be that people moved to this village from their original homes during villagization in the 1970s.

Soil fertility and use of manure
Soil fertility doesn't appear to be perceived by farmers as a major concern. Farmers differentiate a number of soil types. *Striga* is associated with sandy/ poor soils (reported by men and elders) and all soil types(women). Women have reported that manure application is useful for the control of *Striga*. Manure is in widespread use only on fields close to homesteads. Fallowing appears to be rare, then for 2-3 years. Sorghum and millet is dry planted following zero-tillage.

Overall, animal manure is not considered to be in short supply, indeed a local by law requires kraals to be emptied of manure during September each year. Carrying manure to the fields is however a burden. There are limited transport options (usually on the head) for taking manure to fields, particularly away from homestead. Labour may be scarce, particularly in poorer households. If green manure is to be grown some change in the current cultivation and planting practices for sorghum will be needed. *Marajea* could be rotated with sorghum, or millet but this would have labour implications, or undersown into established cereal crops in years of adequate rainfall.

Animal manure appears to be relatively available and transport problems could be addressed (e.g. wheelbarrows). Land may be available for at least some farmers to grow green manure fallow. The main issue is whether there is sufficient perceived need and incentive to carry out these activities.

Inter-cropping
Farmers perceive legumes as requiring more attention than millet and sorghum. A previous survey suggested that land is relatively abundant and therefore farmers see no need to mix cereals and legumes in the same shamba. Farmer strategy needs further research. Long duration sorghum and millet is dry planted with minimum tillage. Groundnuts and bambara require more attention and are planted after rains. Groundnuts (in particular) and bambara tend to be planted separately (as a cash crop). In a survey of 30 farmers in 1999 90% of respondents had grown groundnuts and 100% bambara nuts in the previous three seasons, but none had inter-cropped with cereals. The reason given was that there was sufficient land available and therefore there was no need to inter-crop. However, provisional results from a more recent survey suggest land availability may be an issue for a significant, possibly majority, of farmers.

Some legumes, eg groundnuts, perform better on sandy soils, whereas sorghum and (on a limited scale)maize do well on sandy loams. Farmers don't currently perceive a need or benefit in planting cereals and legumes in the same shamba. Possibly further exploration of

farmer rationale/ incentives and an assessment of overall costs/ benefits of mixing v non-mixing of cereals and legumes at inter and intra household level may be useful.

3.2.2 *Striga* Trials in Chipanga 2000/2001 season

1. Introduction

As many as 22 farmers were originally involved in this season's trials, but only three were women (Table 24) There were two main sets of trials: an evaluation of promising lines/ varieties and a comparison of P9405, Pato and P9406 (with and without manure). Most of the farmers receiving seed planted, but the trials were attacked by army worm at establishment and elegant grasshoppers during grain filling.

Table 24 Chipanga farmers participating in *Striga* trials

Farmer	Sex	Participated in 1999/2000	Participated in 2000/2001	Varieties: P9405, P9406, SRN 39, Macia, Pato	Varieties P9405, P9406 and Pato with and without manure
Rosa Makasi -	F	3	3	3♦	
Magreth Mchewe	F	3	3	3	
Roda Mica	F	3	3	3♦	
John Makasi	M	3	3	3	
Dickson Chilanga:	M	3	3	3	
Jacob Chilanga:	M	3	3	3	
Loti Jackson	M	3	3	3	
Zacharia Mkwala	M	3	3		3♦
Chalos Zecheni	M	3	3		3♦
Richard Mswaya	M	3	3	3♦	
Alex Kamoja	M	3	3		3♦
Mhila Chilobe	M	3	3		3♦
Nolo Chimwagu	M	3	3		3
Kibaya (Bwana sham	M	3	3		3
Agnes Masika:	F	3			
Lazaro Lyingi:	M	3			
Charles Mnyahango	M	3			
Bernard Luseko	M	3			
Yohana Mzungu??	M	3			
Steven Mhagwa	M	3			3
Yahobo Chilanga	M		3	3♦	3
Hamisi Chilosa	M		3	3	3
Yohana Mhindi	M		3		3
Mosi Tati	M?		3		
Stephen Muhagwa	M		3		
Nchalo	M		3		
Rashiod Ngoga	M		3		
Elias Kayela	M		3		

Note:: ♦ = farmer applied animal manure and harvested

A number of individual trial sites were visited with the farmer group. At each site the owner of the field explained to other farmers what had been done and what he/she had observed. Then other farmers asked questions or made comments.

2. Evaluation of sorghum varieties

Farmers were asked to bring examples of sorghum types which are grown in Chipanga. In separate groups, women and men were then asked to name the varieties/ landraces and any

others which they knew were existing in the community. Women and men initially identified 12 and 15 (including Ulezi) 'types' of sorghum respectively. Ten of the sorghum types reported by women and men corresponded. In addition women reported Mgali and Okoa (a pearl millet variety[11]) and men Macia, Lugugu mpya ungu, Hembahemba and Tegemeo[12]. A pair-wise ranking exercise was then carried out to provide an initial ranking and reasons for the preferences, which in turn provided farmers' criteria for distinguishing between sorghum types. A second exercise was then carried out, ranking all the types against each of the criteria.

Women and men identified 12 and 16 criteria respectively for distinguishing and ranking sorghum types (Table 25). Both women and men gave the following criteria: ability to withstand drought, early maturing, high yield, 'heavy' *ugali*, good *ugali*, suitability for local brew *-pombe*, suitability for selling/ good price, whiteness of *ugali*.

Table 25 Farmers criteria for sorghum variety ranking in Chipanga village

Criteria	Women	Men
Ability to withstand drought	3	3
Early maturing	3	3
High yield	3	3
'Heavy' ugali	3	3
Good ugali	3	3
Suitability for local brew Pombe	3	3
Suitability for selling/ Good price	3	3
Whiteness of ugali	3	3
Ability to withstand *Striga inavumilia viduha*		3
Ability to withstand heavy rain		3
Large grain		3
Less easily attacked by pests		3
Not easily attacked by birds		3
Inastahamili magonjwa		3
Ease of de-hulling Kukoboa rahisi	3	
Kupiga ni rahisi		3
Little *pumba* (husk/ chaff)	3	
Suitability to eat like sugarcane		3
Taste of ugali	3	
Provides white flour *Ukikoboa unga mweupe*	3	

Table 26 provides an indicative summary of the various ranking exercises (Tables 27,28,29 and 30 show the detailed results). Women and men appear to be expressing different preferences. The women's group ranked Lugugu the best sorghum type by both methods of evaluation followed by Masiga, P5, Mtika, Chigwala and P6 ie four out of the first six sorghums were landraces. The high ranking of landraces is mainly the result of post-harvest attributes. This compares to men where the first three sorghum types were modern varieties. P9405 was ranked highest by men and was the highest modern variety in the womens' ranking. Men clearly ranked Pato higher than P6, whereas women showed a slight preference for Pato in the pairwise ranking, but against criteria ranked P6 more highly. Macia and Tegemeo were not mentioned by women, but they were both ranked highly by men.

[11] In the woman's group participants were asked for examples of *uhemba* (Kigogo term for sorghum and pearl millet). Initially they used *uwele* (Swahili for pearl millet) as a generic term for all their pearl millet and then one specific type Okoa (a released variety).

[12] Both Hembahemba and Tegemo have been reported in previous discussions with women in Chipanga

Table 26 Overall score for sorghum variety ranking: Women and Men in Chipanga village

	Men			Women			Combined/ Overall		
	Pairwise	Criteria	Average	Pair wise	Criteria	Average	Pair wise	Criteria	Average
P9405	1	2	1.5	5	3	4	3	2.5	2.75
Lugugu	9	6	7.5	2	2	2	5.5	4	4.75
Mtika	7	1	4	4	7	5.5	5.5	4	4.75
Pato	3	4	3.5	7	8	7.5	5	6	5.5
Masiga/ Siga	12	7	9.5	2	4	3	7	5.5	6.25
Chigwala	8	9	8.5	5	6	5.5	6.5	7.5	7
P9406	6	13	9.5	8	5	6.5	7	9	8
SRN39	5	10	7.5	8	10	9	6.5	10	8.25
Serena	14	8	11	12	11	11.5	13	9.5	11.25
Sandala	13	14	13.5	10	9	9.5	11.5	11.5	11.5
H.hemba	11	12	11.5	NR	NR	NR	NR	NR	NR
Lugugu mypa	10	5	7.5	NR	NR	NR	NR	NR	NR
Macia	4	11	7.5	NR	NR	NR	NR	NR	NR
Mgali	NR	NR	NR	11	12	11.5	NR	NR	NR
Okoa	NR	NR	NR	1	1	1	NR	NR	NR
Tegemeo	2	3	2.5	NR	NR	NR	NR	NR	NR
Ulezi	NR	NR	NR	13	13	13	NR	NR	NR

*Note: Okoa is a pearl millet variety; NR = Not reported

Table 27 Ranking of sorghum varieties by farmers' criteria- Women in Chipanga

	Criteria	Selena	Mgali	Masiga	Ulezi	P6	Sandala	CRN39	Chingwala	Pato	Rugugu	Mtika	P5	Okoa*
H	Ability to withstand drought	5	8	8	8	1	6	3	8	3	8	8	1	7
H	High yield	5	7	6	12	3	6	4	9	1	9	11	2	12
H	Early maturing	1	8	8	8	1	1	1	3	6	8	8	1	6
H	Ease of de-hulling *Kukoboa rahisi*	9	12	2	13	6	9	6	4	9	2	4	6	1
M	Provides white flour	11	10	1	13	7	1	8	1	9	1	1	6	12
M	Little *pumba* (husk/ chaff)	12	11	5	13	8	9	7	4	6	2	3	10	1
M	Whiteness of ugali	11	10	1	13	7	5	8	3	9	2	4	6	12
M	Good ugali	12	11	3	13	7	8	10	4	9	2	5	6	1
M	'Heavy' ugali	12	10	4	13	7	9	11	6	8	2	3	5	1
M	Taste of ugali	11	5	4	13	7	10	7	6	9	2	3	7	1
L	Suitability for local brew - *pombe*	5	4	11	3	7	6	9	11	2	11	10	8	1
L	Suitability for selling	9	8	10	1	7	6	5	10	4	10	10	3	2
P	Ability to withstand *Striga*	6	2	2	NK	5	4	3	NK	2	NK	NK-	1	1
Very important criteria		20	35	24	41	11	22	14	24	19	27	31	10	26
Important and very important criteria		89	92	42	119	54	64	65	48	69	38	50	50	54
All criteria		103	104	63	123	68	76	79	69	75	59	70	61	57
Very important criteria		5	12	7	13	2	6	3	7	4	10	11	1	9
Important and very important criteria		11	12	2	13	6	8	9	3	10	1	4	4	6
All criteria		11	12	4	13	5	9	10	6	8	2	7	3	1

*Note: Okoa is a pearl millet variety

Perceptions of importance: H =Higher; M=medium; L=Lower; P= project criterion

Table 28 Pair-wise rankingof sorghum types: - Women in Chipanga

	Selena	**Mgali**	**Masiga**	**Ulezi**	**P6**	**Sandala**	**CRN39**	**Chingwala**	**Pato**	**Rugugu**	**Mtika**	**P5**	**Uwelw**	**Okoa**
Selena		Mgali	Masiga	Selena	P6	Sandala	CRN39	Chingwala	Pato	Rugugu	Mtika	P5	Uwele	Okoa
Mgali			Masiga	Mgali	P6	Sandala	CRN39	Chingwala	Pato	Rugugu	Mtika	P5	Uwele	Okoa
Masiga				Masiga	Masiga	Masiga	Masiga	Masiga	Masiga	Rugugu	Masiga	Masiga	Uwele	Okoa
Ulezi					P6	Sandala	CRN39	Chingwala	Pato	Rugugu	Mtika	P5	Uwele	Okoa
P6						Sandala	CRN39	Chingwala	P6	Rugugu	Mtika	P6	Uwele	Okoa
Sandala							CRN39	Chingwala	Pato	Rugugu	Mtika	P5	Uwele	Okoa
CRN39*								Chingwala	Pato	Rugugu	Mtika	P5	Uwele	Okoa
Chingwala									Chingwala	Rugugu	Mtika	P5	Uwele	Okoa
Pato										Rugugu	Mtika	Pato	Uwele	Okoa
Rugugu											Rugugu	P5	Uwele	Okoa
Mtika												Mtika	Uwele	Okoa
P5													Uwele	Okoa
Uwele+														
Okoa**														
Total	1	2	10	0	5	4	5	7	6	10	9	7	12	12
Rank	12	11	2	13	8	10	8	5	7	2	4	5	1	1

+Uwele refers to peral millet – separate types were not differentiated other than a released variety, Okoa

* CRN39 – as reported by farmers coresonds to SRN39 **Note: Okoa is a pearl millet variety

Table 29 Ranking of sorghum varieties by farmers' criteria- Men in Chipanga

	Macia	Lugugu mpyaungu	Pato	SRN39	P5	P6	Serena	Lugugu	Mtika	Hembahemba	Chigwala	Tegemeo	Sandala	Siga
H1Huvumilia ukame	1	12	5	7	2	4	6	13	8	10	9	3	11	14
H2 Early maturity	1	12	7	6	2	3	4	13	9	11	8	5	10	14
H3 High yield	4	9	1	3	10	14	11	7	6	12	8	2	5	13
H4 Less easily attacked by pests	12	5	8	13	9	11	7	1	3	4	2	10	14	6
H5Ability to withstand heavy rain	14	6	8	9	10	11	7	1	3	5	2	12	13	4
M1Inastahimili magonjwa	10	3	2	1	8	9	4	14	11	12	13	7	6	5
M2 Not easily attacked by birds	11	9	12	8	6	7	1	10	3	5	2	13	14	4
M3 Large grain	8	3	2	6	5	7	10	11	12	13	14	4	9	1
M4 Good price	13	2	7	11	8	12	14	1	3	5	4	9	10	6
M5 Striga tolerance	4	9	8	10	1	2	3	6	7	13	11	5	14	12
M6 'Heavy ugali'	11	5	9	12	6	13	3	1	2	8	4	10	14	7
L1 Easy to thresh	11	2	6	9	10	6	13	1	4	14	3	7	8	5
L2 Good ugali	11	3	9	10	2	14	12	1	4	13	5	8	7	6
L3 Good for local brew	9	11	2	6	1	8	5	12	13	3	14	4	7	10
L4 Whiteness of ugali	8	2	13	7	9	12	14	1	3	10	11	6	4	5
L5 Suitability to eat like sugarcane	10	13	5	8	9	11	6	14	4	1	12	7	2	3
Total	134	106	104	126	98	144	120	108	94	139	122	102	148	115
Ranking	11	5	4	10	2	13	8	6	1	12	9	3	14	7
Overall ranking	4	9	2	8	1	6	14	7	5	11	10	3	13	12

H= high importance; M= medium importance; L=lower importance

Sorghum Ulezi variety was dropped by men as they thought to be less important in the village. Tegemeo although not displayed among the varieties brought by farmers was included in ranking as they thought to be important in the village.

Table 30 Pair-wise ranking of sorghum types -Men in Chipanga

Criteria	Macia	Lugugu mpya ungu	Pato	SRN39	P5	P6	Serena	Lugugu	Mtika	Hembahemba	Chigwala	Tegemeo	Sandala	Siga
Macia		Macia	Pato	Macia	P5	Macia	Macia	Macia	Macia	Macia	Macia	Tegemeo	Macia	Macia
Lugugu mpya			Pato	SRN39	P5	P6	Lugugu m	Lugugu	Mtika	Lugugu m	Chingwala	Tegemeo	Lugugu m	Lugugu m
Pato				Pato	P5	Patp	Pato	Pato	Pato	Pato	Pato	Tegemeo	Pato	pATO
SRN39					p5	srn39	srn39	SRN 39	SRN39	SRN39	SRN39	Tegemeo	SRN39	SRN39
P5						P5	P5	P5	P5	P5	P5	P5	P5	P5
P6							P6	P6	P6	P6	P6	Tegemeo	P6	P6
Serena								Lugugu	Mtika	HembaHemba	Chigwala	Tegemeo	Sandala	Siga
Lugugu									Mtika	Lugugu	Chigwala	Tegemeo	Lugugu	Lugugu
Mtika										Mtika	Mtika	Tegemeo	Mtika	Mtika
Hembahemba											Chigwala	Tegemo	H.hemba	H.hemba
Chigwala												Tegemeo	Chigwala	Chigwala
Tegemeo													Tegemeo	Tegemeo
Sandala														Siga
Siga														
Total	10	4	11	9	13	8	0	5	7	3	6	12	1	2
Rank	4	10	3	5	1	6	14	9	7	11	8	2	13	12

3. Evaluation of use and effects of intercropping

Inter-cropping of cereals and legumes is not a common practice in Chipanga and there were no inter-cropping trials this year. Women and men make the point that yield from two crops will be available. Women reported that a sorghum/ groundnut intercrop improves soil fertility and that sorghum yield will be high if there is sufficient space and if you weed early. A number of weaknesses were identified regarding intercropping of specific legumes with sorghum: bamabara nut will not produce a yield (women), groundnut will not produce a yield (men) and cowpea will crowd out sorghum (men). Women reported that tall sorghum types were more appropriate for intercropping than short types.

Table 31 Perceptions of strengths and weaknesses of intercropping- women and men in Chipanaga

	Strength	Weaknesses
Women	• To get two crops in one area • Improves soil fertility (Sorghum and groundnuts) • Sorghum heads will be big if there sufficient space • Yield is higher if you plant groundnut and bambara nut • High yield if you weed early	• You don't get a yield from bambaranut if planted with sorghum, • The area needs to be big (eneo kubwa hutumika) • The heads will be small if the space is small • Yield is low if you don't weed early • Crop stems become entwined • It depends on the type of sorghum short/ tall –tall is easier/ more suitable to intercrop
Men	• You get many crops. • You get yield from two crops at one time	• If you plant cowpea and sorghum, cow pea crowds out the sorghum • If you plant sorghum and groundnut the same day, the groundnut will not yield-

4. Evaluation of use and effects of manure application

Women and men reported that manure application can increase yields, but men added the qualification that there needs to be sufficient rainfall. Women noted that the response varies depending on the soil type eg on *nkuluhi* and *luseni* soils manure application results in higher yields, but on *ilolo* and *ngogomba* soils it doesn't. Men reported that manure reduce *Striga*. Both women and men reported that manure application causes: crops to dry up more quickly if rainfall is low; an increase in weeds and an increase in pests. Men reported the work involved transporting manure to the fields.

Table 32 Perceptions of strengths and weaknesses of applying farm yard manure (Samadi) - Chipanga

	Strengths	Weaknesses
Women	• *Hustawisha mazao kwenye ardhi ya kichanga* • Large heads • *Ngogomba* soil- usipoweka mbolea unapata mazao mengi ????? • *Nkuluhi* soil - if you put manure you get a higher yield • Griundnuts yield well if manure is applied *Mazao mengi kwenye karanga ukiweka samadi*	• Sorghum dries up if you put manure • Pests attack the crop *Wadudu kula mashina (mchwa)* • On *Ngogomba* soil many pests emerge *wadudu hutokea* • *Ilolo* soil – if you apply manure *mbolea* you don't get a crop • *Kichanga* soil – when you don't apply manure *mbolea* you don't get a good yield when rainfall is low • Many weeds when manure is applied (*Suji*)
Men	• Higher yields if there is sufficient rainfall • Mazao yanakua kwa haraka zaidi • *Striga* is reduced • Soil is made softer	• If rainfall is low crops dry quickly • *Mvua ndogo husanabaisha wadudu wengi* • Weeds increase (Cattle eat different crops) *Mgugu huongezeka (N'gombe kula mimea tofauti)* • Applying manure is a lot of work *Kubeba mbolea ni kazi kubwa*

5. Round-up discussion:
*Sorghum seed production-i*n the group meetings, farmers became involved in very robust discussion about the merits of the different modern sorghum cultivars. A number appear now to be convinced of the value of the early maturing lines, particularly P9405, and are keen to ensure its continued supply in the village. P9406 is also thought to yield well, but tends to be somewhat susceptible to long smut. Although this is a problem on all cultivars in Chipanga, farmers agreed that it is a greater problem on P9406 than P9405. The community was keen to begin planning for local seed multiplication – some farmers with a view to selling the new lines to others. During the past season the Dioscese of Central Tanzania has assisted farmers with multiplication of the newly released variety Macia. This will be available on a greater scale next season. Farmers agreed to think further about arrangements for multiplication of P9405 and to discuss this with the research team in October so that sufficient seed can be provided from Ilonga.

3.3 Summary of main points: Mvumi Makuklu and Chipanga villages, Dodoma

The research environment- there was much more rain than last year, but this was followed by a period of very dry weather.

The research process-there was a further increase in the number of farmers and the proportion (26%) of women involved, but the number of women is still low, particularly in Chipanga. Wealth ranking carried out in October 2000 suggests that we are working with poorer members of the communities.

Variety evaluation-further understanding of farmers' criteria for evaluation of sorghum was gained by researchers. Overall, P9405, P9406 and Pato all enjoy some support in both villages. Pato and P9406 are emerging as the most preferred modern varieties. In Mvumi Makulu, whereas Pato and P9405 are most preferred in Chipanga. There is some evidence to suggest that some farmers may develop a particular loyalty for sorghum types when they are associated with their introduction to the community. Landraces continue to play a key role in livelihoods in these two villages. The project team still appears to have only limited understanding of how farmers are accessing, managing and utilizing different sorghum types. Judicate Mwanga's MSc thesis should provide some useful information and insights.

Use and effects of manure-an evaluation of the use and effects of manure was carried out in Chipanga where livestock numbers are relatively high and manure thought to be much more accessible than in Mvumi Makulu (where an evaluation was carried out last year). The evaluation showed that both women and men associated manure application with increasing yields, but that this was only the case if there was sufficient rainfall and women reported that it was not true for all soil types. Difficulties associated with manure application included an associated increase in weeds and pests.

Intercropping cereals with legumes-an evaluation of intercropping cereals and legumes was carried in Chipanga, where it is not a common practice. Women and men made the point that yield from two crops will be available. Women reported that a sorghum/ groundnut intercrop improves soil fertility and that sorghum yield will be high if there is sufficient space and if you weed early. A number of weaknesses were identified regarding intercropping of specific legumes with sorghum: bamabara nut will not produce a yield (women), groundnut will not produce a yield (men) and cowpea will crowd out sorghum (men). Women reported that tall sorghum types were more appropriate for intercropping than short types.

The way forward-next season, sorghum cultivars (Pato, P9405, P9406 and Macia) will continue to be evaluated with and without manure. Intercropping of sorghum with pigeon pea will be explored. Trials will be established involving the introduction of *marajea* (Crotolaria) after weeding.

4. SUMMARY OF KEY POINTS

The research environment
In the Lake Zone, the general rainfall pattern is bimodal with most rain falling from November to December and from March to April. Potentially, planting may take place with the short rains and/ or the long rains. However, the rains are highly unpredicable and heavy, localized rainstorms separated by dry spells is a common pattern. In 2000/ 2001, the project was realtively successful (for the first time) with trials planted in the shorts rains, but not in the long rains. Dodoma received much more rain than last year which presented possible water-logging problems early in the season, followed by later drought.

The research process
In the Lake Zone, the project is working with farmer research groups initiated by Ukiriguru ARI researchers. There is now increasing involvement of Misungwi district extension staff. In Dodoma, extesion staff continue to play a key role in implementing trials. Is there potential to take this further forward? Can the project facilitate the farmers' groups taking a more pro-active role? Wealth ranking in both zones suggests we are working with some poorer members of the communities. The project is slowly involving more women, but they still form very much the minority in the project's activities. Is it clear why? It is men who usually respond to invitations to meetings. Is this because: women don't hear about the meetings, have low expecations of such meetings or are too busy to come to meetings? Next year extension staff and farmers' groups should be specifically asked to target women. There is some indication that a significant proportion of farmers participating in the May evaluation may not have been familiar with the trials. It is clearly essential that those evaluating have participated in the trials.

Variety evaluation
Farmers are using many criteria to characterise and assess sorghum types. Three criteria were reported by all groups in all villages: drought tolerance, early maturity and yield and a further four criteria were reported by almost all the groups: not easily attacked by birds, ease of marketing, white colour of grain / flour and taste (Appendix 3). Disease and Striga tolerance were generally perceived to be more important in Misungwi (Lake Zone) villages and the attribute of *ugali* to be 'heavy' or 'fill the stomach' and suitability for *pombe* (local brew) in Dodoma (Central Zone). There appeared to be less of a gender divide in terms of criteria, although ease of de-hulling and germination characteristics (in Lake Zone villages) were reported primarily by women. However, women and men may be prioritizing the criteria differently.

In the Misungwi villages, overall women and men expressed a strong preference for modern early maturing, high yielding varieties: Macia, P9405, P9406 and Pato. This may reflect maize rather than sorghum being the preferred food in this area. The actual preference varied between villages and groups and combining the results of both evaluations suggests the most preferred variety is Macia for Iteja women and Mwagala men, P9406 for Mwagala women and P9405 for Iteja men. The exercise should be repeated using all criteria next year. It should be noted that these results are from farmer research groups and it is not clear to what extent they reflect the wider community within the village, the district and Lake Zone.

In the Dodoma villages, P9405, P9406 and Pato all enjoy some support in both villages. Pato and P9406 are emerging as the most preferred modern varieties in Mvumi Makulu, whereas Pato and P9405 are most preferred in Chipanga. There is some evidence to suggest that some farmers may develop a particular loyalty for sorghum types when they are associated with their introduction to the community. Landraces continue to play a key role in livelihoods in these two villages. The project team still appears to have only limited understanding of how farmers are accessing, managing and utilizing different sorghum types.

If the results are aggregated, Macia emerges as the most preferred modern variety according to pair-wise ranking and P9405, P9406 and Macia according to criteria which generally cut across all the study villages (Appendix 5). However, it is the full range of criteria which determines farmers' choice and this cannot be met by a single variety and hence the diversity of sorghum grown, particularly in Dodoma. Some of the farmers involved in these trials have now had access, through the project, to the new modern cultivars for up to four seasons. It is clear, particularly from the assessments undertaken in Dodoma, that some lines (P9405 and P9406) combine *Striga* tolerance/ resistance with some other traits liked by farmers, including early maturity, drought tolerance and, to some extent, palatability. There would therefore appear to be a niche for these lines and participating farmers (particularly in the Dodoma villages) have indicated a strong desire that they are made more widely available.

Use and effects of manure

The Wasukuma have long realized the usefulness of manure and its use was more common in the past. As access to land increased use of manure declined, but with land availability becoming a problem, manure use has again increased and 50% of households in Misungwi were estimated to be using manure in 1990/91. All groups reported that the application of manure improves yield and three groups noted that it reduces Striga. However, the use of manure is associated with increased weeds and its effect can be detrimental if there is insufficient rainfall. The need for transport to fields and expertise were noted by both groups of men. The project team needs to assess whether it is sufficiently building on previous soil fertility work undertaken by Ukiriguru researchers in these villages.

An evaluation of the use and effects of maunre was carried out in Chipanga where livestock numbers are relatively high (compared to Mvumi Makulu) and manure thought to be much more accessible than in Mvumi Makulu (where an evaluation was carried out last year). The evaluation showed that both women and men associated manure application with increasing yields, but that this was only the case if there was sufficient rainfall and women reported that it was not true for all soil types. Difficulties associated with manure application included an associated increase in weeds and pests.

Intercropping cereals with legumes

Inter-cropping of cereals with legumes is a common practice in the Lake Zone. Women and men reported that intercropping with legumes improves soil fertility, can reduce the workload and that it reduces *Striga*.. Men in both villages noted that it addressed the issue of land shortage. However, both men and women reported that inter-cropping can impede weeding and that the yield of the main or cash crop may be less. In Iteja, women reported that pests and *Striga* may be increased. Men in the same village reported a need for more knowledge and the difficulty of managing crops with different management requirements.

An evaluation of intercropping cereals and legumes was carried in Chipanga, where it is not a common practice. Women and men made the point that yield from two crops will be available. Women reported that a sorghum/ groundnut intercrop improves soil fertility and that sorghum yield will be high if there is sufficient space and if you weed early. A number of weaknesses were identified regarding intercropping of specific legumes with sorghum: bamabara nut will not produce a yield (women), groundnut will not produce a yield (men) and cowpea will crowd out sorghum (men). Women reported that tall sorghum types were more appropriate for intercropping than short types.

The way forward

In Lake Zone, in a meeting of the project team it was decided that trials involving sorghum lines and manure would continue on *luseni* (sandy) and *mbuga* (heavy) soils. Inter-cropping trials would continue for one more season. In Dodoma next season, sorghum cultivars (Pato, P9405, P9406 and Macia) will continue to be evaluated with and without manure.

Intercropping of sorghum with pigeon pea will be explored. Trials will be established involving the introduction of *marajea* (Crotolaria) after weeding.

Appendix 1 Farmers involved in trial evaluations in May 2001

VILLAGE	WANAWAKE (Women)	WANAUME (Men)
Iteja	Mangeri Lufilisha Kefuleni Mufungua Lusia Josefu Feloruka Kelemeli	Kidiga Chandaruba Samuel Stephano Rumadhani Masharo Paulo Katanuku Nkayaga Kasmiry Buuzari Chameuche Mabula Doto Mastouda Tigiti Piter Luchemba James Saulo Gidioni Bujiku Omary Mgese Nuerer Maula Mwalimu Shigi Samuel Malulu
Mvumi Makulu	Liliani Msihi Olipa Mazengo Mariam Chalyilyilyo Yudithi Chute Elizabethi Mazencro Jemiua Mdhalila Magrethi Mazengo Mary Mabichi Esta Chiute Rossimery Mabwe	Simon Mbwame Atamasi Mastonya Amdason Massi Richardi Myamwamji Charles Malamba David Nzogolo Yorami Mcrossi Yohana Nhibu Samsomi Mtyami Aidani Nzogolo Simoni Chedecro Stanley Sacrasi
Chipanga	Magret Mchewe Roza Makasi Sonia Mdugala Pili Kangwe Roda Mica	Zakaria Mkwala Elias Kayela Rashidi Ngoga Stephen Mhagwa Mangwela Kachiwile Yakabo Chilanga Mhumpa Kachiwile Loti Jackson John Makasi Augustino Kibaya (A/Kilimo) Richard Mswaya

Appendix 2 –Original versions of evaluations in Swahili

(a) MWAGALA VILLAGE

Variety Ranking - Men in Mwagala Village

Vigezo	PATO	MACIA	P9406	P9405	Waijita	SRN 39	Mwanagudungu	Makulya	Mpapmasaba	Mningamela	Ngh'olongo
Masuke makubwa	1	1	2	3	4	3	4	2	3	5	1
Hustahimili ukame	2	1	2	1	4	3	1	3	1	5	1
Hustahimili viduha	3	1	1	1	3	2	5	?	4	3	3
Haushambuliwi na wadudu/ndege	5	2	2	2	1	2	1	1	3	1	1
Ugali laini	1	1	1	1	1	2	4	2	2	5	1
Unga mweupe	1	2	2	2	4	2	4	4	3	5	3
Haushambuliwa magonjwa	4	2	1	1	1	2	4	2	3	5	3
Inakomaa upesi	2	1	1	1	3	2	2	3	1	4	5
Mabua yanaweza kutumika	2	4	4	4	2	3	4	2	4	1	1
Iwe nzuri kwa biashara	1	2	2	2	3	3	2	4	1	5	2
Jumla	22	17	18	18	26	24	31	23	25	37	21
Daraja la ubora	5	1	2	2	9	7	10	6	8	1	4

DARAJA: 1=Nzuri sana, 2= Nzuri, 3=Wastani, 4= Mbaya, 5= Mbaya sana

Pair-wise Ranking - Men in Mwagala Village

Vigezo	(1) PATO	(2) MACIA	(3) P9406	(4) P9405	(5) Waijita	(6) SRN 39	(7) Mwanagudungu	(8) Makulya	(9) Mpapmasaba	(11) Mningamela	(10) Ngh'olongo
PATO		2	1	4	1	1	1	1	9	1	1
MACIA			2	2	2	2	2	2	9	2	2
P9406				3	3	3	3	3	9	3	3
P9405					4	4	4	4	9	4	4
Waijita						6	7	8	9	5	10
SRN39							6	6	9	6	6
Mwanangudungu								7	9	7	7
Makulya									9	8	10
Mbapasaba										9	9
Miningamela											10
Ng'holongo											
TOTAL	7	9	7	7	1	5	4	2	10	0	3
DARAJA	5	2	3	3	10	6	7	9	1	11	8

Matokeo ya kupanga vigezo ambavyo mkulima anaweza akachagua aina fulani ya mtama yameonyeshwa kwenye jedwali hapo juu. Pia kulinganisha kati ya aina moja na nyingine imeonyeshwa. Kwa ujumla mbegu Macia imeonyesha kukubalika zaidi na wanaume ikifuatiwa na P5 na P6. Kitu mabacho hakikutarajiwa ni kuona mbegu Mbaba saba kuwa ja kwanza kwenye uchaguzi wa mbegu ingawa ilishika nafasi ya 8 katika kuainisha vigezo. Madiliko hayo yanaweza kuwa yalisababishwa na ukweli kwamba wakati wa zoezi hilo kuna baadhi ya wasailiwa kuwa na uwezo mkubwa wa kushawishi kuhusu ubora wa mbegu hiyo. vizuri pia kufanyia utafiti zaidi aina hiyo ya mbegu ili kubainisha ukweli wake.

Aina zingine za Mtama unaolimwa Mwagala ni: Tengemea (Tegemeo); Kapongo; Bukula; Wilu;Serena

Strength and weaknesses of intercropping -Wanaume, Mwagala

Faida	Hasara
• Unapata mazao ya aina mbalimbali katika shamba moja • Jamii ya mikunde ikiwepo kwenye mchanganyo hurutubisha ardhi • Kuchanganya kunapunguza kazi kwani mtu huwa na shamba moja • Ni vizuri kama kuna uhaba wa ardhi • Inaweza kupunguza uwingi wa magugu	• Mavuno kwa zao kuu hupungua kwa kugombania chakula na maji • Palizi huenda polepole sana kama umechanganya

Strength and weaknesses of applying farm yard manure (Samadi)- Wanaume, Mwagala

Faida	Hasara
• Mavuno huongezeka ukitumia samadi • Viduha hupungua • Ukiendelea kuweka samadi kwa muda mrefu vuduha huisha kabisa • Inaweka unyevuunyevu hivyo unaweza kuvuna hata kama mvua ni chache • Mimea hudumaa kama hukuweka samadi.	• Kama mvua ni chache ukiweka samadi mimea huathirika • Unahitaji kuwa na nyenzo za kusombea samadi • Inahitaji utaalamu wa kutumia samadi

Variety Ranking - Women in Mwagala Village

Vigezo	P5	Gugungu	SRN39	P6	Muninga	Mbapa saba	Wengita	Pato	Makulya	Macia
Suke ni kubwa	5	7	5	4	10	8	2	1	9	3
Mbegu ni kubwa	2	9	7	2	10	8	5	4	6	1
Tamu kwa kula	5	10	4	3	9	2	6	1	7	8
Mtama wake ni mwingi	6	9	6	4	8	3	2	10	1	5
Inavumilia wadadu shamabi	5	9	5	4	10	7	2	1	3	8
Inavumulia ukame	5	7	5	3	9	8	1	10	2	4
Inavumilia ndege	5	3	6	4	7	9	1	9	1	8
Inavumilia kiduha	2	7	6	2	9	5	4	10	1	8
Ina mavuno mengi	5	9	4	3	10	8	2	1	6	7
Inashambuliwa ugonjwa*	9	3	7	6	5	8	2	10	1	4
Udtaji wake nzuri	1	8	5	1	9	10	6	3	7	4
Ni nyepesi kuiva	1	10	7	1	9	8	4	3	6	5
Ni nzuri kwa soko	2	9	5	2	10	7	6	4	8	1
Kula ni nzuri inaongezeka damu	8	3	9	7	4	5	2	6	1	10
Inavumilia wadudu kwenye stoo	1	10	3	4	6	8	7	9	5	2
Jumla	62	113	84	50	127	104	52	91	65	78
Daraja la ubora	3	9	6	1	10	8	2	7	4	5

*Awali vigezo vya wakulima vililenga kuonyesha kuwa aina ya mtama inayoshambuliwa na magonjwa. Baadaye vigezo hivyo vilibadilishwa kuainisha aina zile stahimili magonjwa

Pair-wise Ranking - Women in Mwagala Village

	P5	Gugungu	SRN39	P6	Muninga	Mbapa saba	Wengita	Pato	Makulya	Macia
P5		P5	P5	P6	P5	P5	Wengita	Pato	makulia	Macia
Gudungu			SRN39	P6	Gudungu	Mbapa saba	Wengita	pato	makulia	Macia
SRN39				P6	SRN39	Mbapa saba	SRN39	Pato	SRN39	Macia
P6					P6	P6	P6	P6	P6	Macia
Muninga						Mbapa saba	Wengita	Pato	Makulia	Macia
Mbapa saba							Wengita	Pato	makulia	Macia
Wengita								Wengita	Wengita	Macia
Pato									Pato	Macia
Makulya										Macia
Masia										
Jumla	4	1	4	8	0	3	6	6	4	9
	5	9	5	2	10	8	3	3	5	1

Pair-wise Ranking - explanation for preferences: Women in Mwagala Village

	P5	Gudungu	SRN39	P6	Muninga	Mbapa saba	Wengita	Pato	Makulya	Macia
P5		P5 Suke ni kubwa; Show yake ni nzuri kwa soko; Tamu kwa kula na ni laini; Mbegu yake ni kubwa	P5 Uotaji mzuri; Inavumilia magonjwa; Ina masuke makubwa/ mavuno ni mengi; Nzuri kwa kula; Ina soko.	P6 Suke kubwa kuliko P5; Inavumilia wadudu shambani; Tamu kwa kula; Soko lake ni nzuri.	P5 Uotaji mzuri; Inavumilia magonjwa; Masuke makubwa/ mavuno mengi; Ni laini kwa kula; Soko lake ni nzuri.	P5 Uotaji wake nzuri; Inavumilia magonjwa; Masuke makubwa/ mavuno mengi; Soko ni nzuri Ni laini kwa kula.	Wengita Suke lake ni kubwa; Mtama wake ni mwingi; Inavulimia ukame na magonjwa eg ndege, stalkborer; Inavumilia kiduha.	Pato Ina mavuno mengi; Ni tamu kwa kula; Ijapo inashambuliwa na ugonjwa, inazaa tu; But: (*Inashambuliwa sana ne ndege; inashambaliwa na stalkborer; inashambaliwa na ugonjwa*).	Makulya Uotaji wake nzuri; Inavumilia wadudu na magonjwa; kula ni nzuri inaongezeka damu; mavuno yake ni mwengi.	Macia Ni nyepesi kuiva; Inavulimia wadudu na magonjwa; ina mavuno mengi; ina soko nzuri kwa sababu picha yake ni nzuri.
Gudungu			SRN39 Inaiva mapema; Mavuno ni mengi; Inavulimia wadudu kwenye stoo; Ni tamu kwa kula; Ina soko.	P6 Nyepesi kuota; Inaiva mapema; Nzuri kwa kula; Ina soko nzuri; inavumilia wadudu.	Gudungu Inaota haraka; Ina mavuno mengi; ina soko nzuri; Ugali wake mzuri kuliko muninga.	Mbapa saba Inaota vizuri; Inavumilia magonjwa; Masuke yake ni makubwa; Tamu kwa kula; soko ni nzuri.	Wengita Inaota vizuri; Inavumilia magonjwa; Inamavuno mengi; Soko lake ni nzuri; Inaiva mapema.	Pato Inaota haraka; Ina mavuno mengi; Kula ni nzuri; Soko ni nzuri; Inaiva haraka.	Makulya Inaota upesi; Inavumilia wadudu na magonjwa; mavuno mengi; kula ni laini.	Macia Inaota haraka; Mavuno mengi; Inavumilia wadudu na magonjwa; Tamu kwa chakula.
SRN39				P6 Inaota vizuri; Ina mavuno mengi; Nzuri kwa kula; Ina soko nzuri.	SRN39 Inaiva mapema; mavuno ni mengi; Inavumilia wadudu kwenye stoo; Ni tamu kkwa kula; ina soko.	Mbapa saba Inaoto haraka; Inavumilia magonjwa; masuke yake ni kubwa; Mavuno mengi.	SRN39 Inaota harake; Inaiva mapema; Ina mavuno; Ina soko nzuri; Tamu kwa kula.	Pato Inamavuno mengi/ masuke makubwa; tamu kwa kula; Soko lake ni nzuri; Inatoa mavuno hata akishambiliwa wadudu/ magonjwa.	SRN39 Inaota haraka; Ina mavuno mengi; kula ni nzuri; soko lake ni nzuri; Inaiva haraka.	Macia Inaota haraka; Inavumilia wadudu/ magonjwa; ina mavuno mengi; kula ni nzuri; Ina soko nzuri.
P6					P6 Inaota haraka;	**P6** Inaota haraka;	**P6** Inaota haraka;	P6 Inaota haraka;	P6 Inaota vizuri;	Macia inaota haraka;

					Inavulimia magonjwa; Tamu kwa kula; Ina soko nzuri; Ina mavuno mengi.	Inavumilia wadudu/ magonjwa; Ina mavuno mengi; Soko ni nzuri; tamu kwa kula.	Inavulimia magonjwa; Mavuno mengi; Soko zuri; Tamu kwa kula.	Inastahimili magonjwa / wadudu/ / ndege; kula ni nzuri; Ina mavuno mengi.	Inaota haraka; Inastahimili magonjwa / wadudu/ / ndege; kula ni nzuri; Ina mavuno mengi.	Inavulimia magonjwa/ wadudu; Ina mavuno mengi; Kula ni tamu; Soko lake ni nzuri.
Muninga						**Mbapa saba** Inaota haraka; Inavulimia wadudu/ magomjwa; Mavuno mengi/ ina suke kubwa; Soko ni nzuri; Kula ni laini.	**Wengita** Kuota haraka; Inavumilia nzuri; Mavuno mengi/ suke kubwa; Laini kwa kula; Ina soko nzuri.	**Pato** Inaota haraka; Ina mavuno mengi; Soko kubwa; Ni nzuri kwa kula.	**Makulia** Inaota vizuri; Ina mavuno mengi; Kula ni nzuri; Soko nzuri.	**Macia** Inaota haraka; Inavumilia magonjwa/ wadudu; Mavuno mazuri/ kwa suke; Kula ni nzuri; Ina soko nzuri.
Mbapa saba							**Wengita** Inaote haraka Inavumilia magonjwa/wadudu//ndege, Ina mavuno mengi/suke kubwa, Ni tamu kwa kula, in soko kubwa	**Pato** Inaota vizuri Inavumilia wadidu magonjwa, Mavuno mengi, Soko zuri, Tamu kwa kula	**makulia** Inaota vizuri, Inavumilia magonjwa, mavuni mengi, Laini kwa kula, Soko zuri	**Macia** Inaota haraka, kula ni nzuri, Mavuno mengi, Soko ni zuri
Wengita								**Wengita** Uotaji ni mzuri, Inavumilia magonjwa/wadudu/ndege Mavuno mengi, Masuke makubwa	**Wengita**, Inaota vizuri, Inavumilia wadudu/magonjwa, Ina mavuno mengi, Ina soko zuri,	**Macia** Uotaji ni mzuri, Inavumilia magonjwa, Mavuno mengi, Soko zuri
Pato									**Pato** Inaota vizuri, Ina mavuno mengi, Nzuri kwa kula	**Macia** Inaota vizuri, Inavumilia magonjwa/wadudu/ndeg,

										Mavuno mengi, Soko zuri,
Makulya										**Macia** Inaota vizuri, Inavumilia magonjwa, Mavuno mengi, Kula laini, Soko zuri
Masia										
Jumla	4	1	4	8	0	3	6	6	4	9
	5	9	5	2	10	8	3	3	5	1

Strength and weaknesses of intercropping- Women in Mwagala

Faida (Strength)	Hasara Weaknesses
• Kupata mavuno mengi • Inaongeza mbolea kwenye udongo • Kupunguza viduha shambani	• Kushindwa palllia • Unapata mavuno kigogo kwa kila zao

Strength and weaknesses of applying farm yard manure (Samadi) - women in Mwagala

Faida	Hasara Weaknesses
• Rutubisha ardhi • Unapata mazao mengi • Unapunguza kiduha • Unahifadhi ardhi	• Ukiweka nyingi bila kipimo mazao hayazai eg mihogo, viazi, karanga • Magugu huongezeka shambani • Palizi huongezeka

Appendix 1(b) ITEJA VILLAGE

Variety Ranking - Men in Iteja Village

Vigezo	KAKULA	TEGEMEO	P9405	WEIJITA	SRN39	MBAPA SABA	NGHOLONGO	P6	PATA	NGUDUNGU	MACIA
KUKOMAA HARAKA	2	6	7	10	9	1	11	8	3	4	5
NZURI KWA BIASHARA	11	4	2	10	5	7	8	3	1	9	6
HUVULIMIA viduha	5	9	1	8	4	6	10	2	11	7	3
HUTOA MAZAO MENGI	11	9	2	8	5	10	7	3	1	6	4
HAIBUNGULIWI NA WADUDU (STOO)	6	8	2	10	5	11	7	3	1	9	4
HUVULIMIA UKAME	6	9	2	10	7	8	1	3	11	5	4
RANGI NYEUPE	11	6	5	9	2	8	7	4	3	10	1
HAISHAMBULIWI NA NDEGE	1	10	4	2	9	6	7	5	11	3	8
INA LATHA NZURI	11	6	3	10	5	8	7	4	1	9	2
Juamla	64	67	28	77	51	65	65	35	43	62	37
Daraja la ubora	7	9	1	10	5	8	8	2	4	6	3

Pair-wise Ranking - Men in Iteja village

Vigezo	(1) KAKULA	(2) TEGEMEO	(3) P9405	(4) WEIJITA	(5) MBAPA SABA	(6) SRN 39	(7) MASIA	(8) NGUDUNGU	(9) PATO	(10 P6	(11 Ngh'olongo
KAKULA		2	3	4	5	6	7	8	9	10	11
TEGEMEO			3	2	2	6	7	2	9	10	2
P9405				3	3	3	7	3	9	3	3
WEIJITA					5	6	7	8	9	10	11
MBAPA SABA						6	7	8	9	10	5
SRN39							7	6	9	10	6
MACIA								7	9	7	7
NGUDUNGU									9	10	8
PATO										9	9
P6											10
Ng'holongo											
JUMLA	0	5	8	1	3	6	9	4	10	7	2
Daraja la ubora	11	6	3	10	8	5	2	7	1	4	9

Aina zingine za Mtama unaolimwa Iteja ni: Hamna

Faida na hasara kupanda mchanganyikio wao mazaoa **-Wanaume Iteja**

Faida	Hasara
• Unapata mazao ya aina nyingi katika shamba moja • Mchanganyiko Jamii ya mikunde hupnguza viduha • Kuchanganya kunapunguza kazi kwani mtu huwa na shamba moja • Jamii ya mikunde hurutubisha ardhii • Kutokana na uhaba wa ardhi unaweza ukapata mazao aina nyingi katika shamba moja	• Zao lililokusudiwa kulimwa huathirika na kupata mazao kidogo • Zao jingine litakosa huduma kama dawa ili tu kulinda zao jingine • Kuchanganya mazao kunahitaji elimu zaidi ya mazao

Faida na hasara kutumia Samadi - Wanaume Iteja

Faida	Hasara
• Mavuno huongezeka ukitumia samadi • Viduha hupungua • Inaweka unyevuunyevu hivyo unaweza kuvuna hata kama mvua ni chache • Gharama kidogo ukilinganisha na mbolea ya chumvichumvi.	• Kama mvua ni chache ukiweka samadi mimea huathirika • Unahitaji kuwa na nyenzo za kusombea samadi • Hatuna elimu ya uwingi wa virutubisho katika mbolea ya samadi • Magugu mengi huota kama utatumia samadi

Variety Ranking - Women in Iteja Village

Vigezo	Pato	Weijita	P6	P5	Macia	SRN39	Mwanagudungu	Tegemeo	Mbapa saba
Inakoboleka	1	3	?	?	?	3	3	2	3
Ni tamu kwa kula	3	7	5	2	1	6	8	4	9
Inavumulia ukame	7	9	3	2	1	4	5	6	8
Masuke makubwa/ mavuno mengi	4	6	3	2	1	5	8	7	9
Inaota upesii	4	8	3	2	1	6	7	5	9
Inakomaa upesi	5	9	3	2	1	4	8	6	7
Iavumilia magonjwa/ wadudu	7	9	3	2	1	4	6	5	8
Inavumilia viduha*	5	9	3	2	1	4	6	7	8
Ina soko nuri	1	8	5	4	3	9	6	2	7
Inaiva mapema	7	9	3	2	1	5	8	4	6
Mtama wake ni mweupe	3	9	5	4	2	6	7	1	8
Palizi moja tu, inatosha	8	9	1	1	1	1	7	5	8
inavulimia ndege	7	1	4	5	6	3	1	8	9
Ni rahisi kupiga	1	2	6	5	3	9	8	4	6
Jumla	62	95	47	35	23	66	85	64	99
	4	8	3	2	1	6	7	5	9

* Researcher criterion; Aina zingine za Mtama unaolimwa Iteja ni:Serena

Pair-wise Ranking - Women in Iteja Village

	Pato	Weijita	P6	P5	macia	SRN39	Mwagudungu	Tegemeo	Mbapa saba
Pato		Pato	P6	P5	macia	Pato	Patoa	Pato	Pato
Weijita			P6	P5	Macia	SRN39	Mwagudungu	Tegemeo	Mbapa saba
P6				P5	Macia	P6	P6	Tegemeo	P6
P5					Macia	P5	P5	Tegemeo	P5
Macia						Macia	Macia	Macia	Macia
SRN39							SRN39	Tegemeo	SRN39
Mwangudungu								Tegemeo	Managudungu
Tegemeo									Tegemeo
Mbapa saba									
Jumla	5	0	5	6	8	3	2	6	1
	4	9	4	2	1	6	7	2	8
Overall	4	8	3	2	1	6	7	5	9

Pair-wise Ranking - explanation for preferences: Women in Iteja village

	Pato	Weigita	P6	P5	Macia	SRN 39	Mwanagudungu	Tegemeo	Mbapa saba
Pato		Pato Inakoboleka, Tamu kwa kula, Inavumilia ukame, Ina mavuno mengi, Ina soko nzuri.	P6 Masuke makubwa mavuno mazuri, Inaota upesi, Inakomaa upesi, mtama wake ni mweupe, Inavumilia magonjwa wadudu, Soko lake ni zuri.	Pato Inaota haraka, Palizi moja tu inatosha, Inavumulia magonjwa, Ina mavuno mengi/suke kubwa.	Macia inavumulia jua, Inavumilia magonjwa/wadudu, Inakomaa haraka. .	Pato Ni tamu kwa kula, inakoboleka, Ina soko nzuri.	Pato Ugali ni mzuri, Ina soko nzuri, Inakoboleka, Ina mavuno mengi, Ni rahisi kupika.	Pato Kama kulia, Inavumilia zaidi ndege..	Pato Ina ugali mzuri, Ina soko nzuri, Kama hapo juu.
Weigita			P6 Ina ugali mzuri, Inaota mapema, Inavumilia jua, Inaiva mapema/palizi moja tu, ina soko nzuri..	P5 Inaota mapema, Inakua haraka, Ina ugali mzuri, Ina soko nzuri.	Macia Inaota haraka; Ina komaa mapema, Haishambuliwina wadudu, Ina soko nzuri, Ni tamu kwa kuala	SRN 39 Inaiva mapema, Inaota mapema, Ugali wake ni mzuri, Soko lake ni zuri.	Mwanagudungu Inavumilia ukame, Masuke yake yana mtama mwingi, Ina ugali mzuri.	Tegemeo Ugali mzuri, Ina soko nzuri, Ina komaa mapema, Ina mavuno mengi..	Mbapa saba Ina mavuno mengi, Ina soko zuri, Ina komaa mapema.
P6				P5 Inaota mapema, Inavumilia wadudu, Ina soko zuri, Ina ugali mzuri, Ina mavuno mengi	Macia ina mavuno mazuri, Inavumilia ukame, Ianvumulia maginjwa/wadudu, Ina mtama mweupe.	P6 Inaoto mapema, Inavumilia magonjwa, Ugali wake ni mzuri, Ina soko zuri	P6 Inaota harake; Ina soko, Ugali mzuri, Ina mavuno mengi, Inavumilia magonjwa/wadudu	Tegemeo Inaota mapema, Inaiva mapema, Inakubali kukobolewa,Ina soko nzuri, Ina mavuno mengi.	P6 Inaota haraka; Inakomaa haraka, Ugali wake ni mzuri, Soko lake ni zuri, Haishambuliwina wadudu
P5					Macia Inaota upesi, Inakomaa mapema, Inavumilia ukame, Inatoa mazao	**P5** Inaota upesi, Ina masuke makubwa/mavuno mengi, Ina ugali mzuri, Ina soko zuri.	**P5** Inaota haraka; Inavulimia wadudu, Inakomaa upesi, Ugali wake ni mzuri.	Tegemeo Ina soko zuri, Ina ugali mzuri, Inavumilia wadudu, Suke kubwa/mavuno	P5 Inaota mapema, Inavumilia ukame, Inakomaa mapema, ina soko zuri,

					mengi, Ina soko nzuri.		Ina soko zuri.	mengi.	Ina ugali mzuri..
Macia						**Macia** Inaota haraka shambani, Inakomaa mapema, Inavumilia ukame, Inavumilia wadudu, Ina masuke makubwa/mavuno mengi, Ugali mzuri, Soko zuri	**Macia** Kama hapo nyuma	**Macia** Kama hapo nyum	**Macia** Kama hapo nyuma
SRN 39							**SRN 39** Inaote upesi shambani, Inakua haraka, Inakomaa haraka, Ugali wake ni mzuri, Soko lake ni zuri.	**Tegemeo** Inaota haraka, Inakomaa upesi, Mavuno mengi, Ugali mzuri, Ina soko zuri.	**SRN 39** Inaota vizuri, Haishambuliwi na wadudu, Hukomaa haraka, Ina ugali mzuri, Soko zuri
Mwanagu dungu								**Tegemeo** Inaota haraka shambani, Inaiva upesi, Ina soko zuri, I	**Mwanagudung u** Inaota vizuri, Inavumilia ukame, Ugali mzuri, Soko zuri.
Tegemeo									**Tegemeo** Inaota vizuri, Inakua vizuri shambani, inavumilia ugonjwa/wadudu , Mavuno mengi,

									nyeupe, Soko lake ni zuri.
Mbapa saba									
Jumla	4	1	4	8	0	3	6	6	4
	5	9	5	2	10	8	3	3	5

Strength and weaknesses of intercropping- Women in iteja

Faida (Strength)	Hasara Weaknesses
• Inapunguza kazi • Chakula kinaiva pamoja	• Kupunguza mavuno ya karanga • Viduha vinaongezeka ukipanda mtama na kunde(kiduha - rangi orange na zamabarau) • Ukichangana mihogo na kunde mihogo inadhurika • wadudu wanaongezeka

Strength and weaknesses of applying farm yard manure (Samadi) - women in Iteja

Faida	Hasara Weaknesses
• Inaongeza mavuno • Mazao inakua haraka • Inarutubisha ardhi • Udongo unatunza maji	• Magugu yaongezeka • Palizi nyingi • kama jua kali ardhi inakauka zaidi sehemu yenye mbolea nyingi

Appendix 1 (c) MVUMI MAKULU

MVUMI MAKULU - VARIETY PREFERENCE MEN AND WOMEN

	Vigezo	Tegemeo	Mhuputa	Sandala	Pato	Lugugu	P6	P5	Lugugu wa Arusha	Bangala
Muhimu sana	Mavuno mengi	4	8	5	1	9	2	3	6	7
Muhimu sana	Huvumilia ukame	4	7	5	3	9	1	1	6	8
Muhimu sana	Huvimilia viduha	4	9	5	3	8	2	1	6	7
Muhimu sana	Mtama mfupi	3	7	5	4	9	2	1	6	8
Muhimu sana	Soko	9	6	3	5	1	6	5	2	4
Muhimu sana	Haushambuliwi na ndege	6	3	5	7	2	8	9	4	1
Muhimu sana	Haushambuliwi wa wadudu	6	2	5	9	1	7	8	4	3
Muhimu sana	Haupukutiki shambani	4	9	5	3	8	2	1	6	7
Muhimu sana	Haushambuliwi na wadudu stoo	9	2	6	5	1	7	8	3	4
Muhimu sana	Ugali mtamu	9	3	7	8	1	6	5	2	4
Muhimu	Shina imara	9	6	2	1	4	8	8	3	5
Muhimu	Suke kubwa	6	9	8	1	4	2	3	5	7
Muhimu	Punje kubwa	7	9	6	1	8	4	5	3	2
Muhimu	Unakoboleka kwa urahisi	9	2	5	6	3	7	8	4	1
Muhimu	Ugali mweupe	5	1	4	8	3	6	6	2	9
Siyo muhimu sana	Pumba kidogo	9	1	5	8	2	6	6	3	4
Siyo muhimu sana	Hurudiwa kuvuna	5	1	HJ	4	HJ	2	2	HJ	HJ
Siyo muhimu sana	Pombe nzuri	HJ	1	HJ	3	2	HJ	HJ	HJ	HJ
	Very important	58	56	51	48	49	43	42	45	53
	Very important and important	94	83	76	65	71	70	72	62	77
	All criteria	103	84	81	73	73	76	78	65	81
	Very important	9	8	6	4	5	2	1	3	7
	Very important and important	9	8	6	2	4	3	5	1	7
	All criteria	9	8	6	2	2	4	5	1	6

Pairwise ranking of sorghum varieties in Mvumi Makulu - Men and Women

	Tegemeo	Mhuputa	Sandala	Pato	Lugugu	P6	P5	Lugugu wa Arusha	Bangala
Tegemeo		**Tegemeo**=10 Mhuputa=5 NR=4	**Tegemeo**=12 Sandala =7	**Pato**=19 Tegemeo=0	**Tegemeo**=17 Lugugu=0 NR-2	**P6**=17 Tegemeo=2	**P5**=17 Tegemeo=1	**Tegemeo**=15 Lug. wa Arusha=2	**Tegemeo=**18 Bangala=0
Mhuputa			**Sandala**=18 Mhuputa=0	**Pato**=18 Mhuputa=0	**Mhuputa**=16 Lugugu=0	**P6**=18 Mhuputa=0	**P5**=18 Mhuputa=0	**Lu. wa Arusha**=7 Mhuputa=8 NR =1	**Bangala**=11 Mhuputa=6
Sandala				**Pato**=17 sandala=0	**Sandala**=17 Lugugu=0	**P6**=16 Sandala=0	**P5**=14 Sandala=2	**Sandala**=17 Lug. wa Arusha= 0	**Sandala**=16 Bangala=0
Pato					**Pato**=17 Lugugu=0	**P6**=10 Pato=5	**Pato**=11 P5=6	**Pato**=17 Lug. wa Arusha =0	**Pato**=17 Bangala=0
Lugugu						**P6**=18 Lugugu=0	**P5**=18 Lugugu=0	**Lug wa Arusha**=11 Lugugu=?	**Bangala**=16 Lug wa Arusha=1
P6							**P6**=13 P5=0 NR=2	**P6**=15 Lug wa Arusha=0	**P6**=16 Bangala=1
P5								**P5**=15 Lug wa Arusha=0	**P5**=16 Bangala=0
Lugugu wa Arusha									**Lug wa Arusha**=11 Bangala=0
Bangala									
	5	2	4	7	0	8	6	2	2
	4	6	5	2	9	1	3	6	6

Pairwise ranking of sorghum varieties in Mvumi Makulu - Men and Women

	Tegemeo	Mhuputa	Sandala	Pato	Lugugu	P6	P5	Lugugu wa Arusha	Bangala
Tegemeo		**Tegemeo**=10 Mhuputa=5 NR=4 Mazao mengi, Inavumilia ukame, Mabua yanaoza haraka, Unaweza ukavuna maotea, Una soko zuri	**Tegemeo**=12 Sandala =7 Ugali ni mtamu, Inavumilia ukame, Nzuri kwa kande, Nzuri kwa uji, unga ni laini	**Pato**=19 Tegemeo=0 Mazao ni mengi, Ugali/kande nzuri, Suke kubwa, Punje kubwa, Haibunguliwi sana, Nzuri kwa biashara, Ina pombe nzuri	**Tegemeo**=17 Lugugu=0 NR-2 Inakomaa haraka, Inavumilia ukame	**P6**=17 Tegemeo=2 Inavumilia ukame, Nzuri kwa ugali na kande, Inakoboleka, Ina pumba kidogo,	**P5**=17 Tegemeo=1 Inachanua haraka, Inavumilia ukame, Ni fupi, Inatoa mazao mengi, Ugali na kande ni nzuri	**Tegemeo**=15 Lug. wa Arusha=2 Hustahimili ukame, Haipukutiki shamabani kama Lugugu Arusha	**Tegemeo**=18 Bangala=0 Inakomaa haraka, Mavuno ni mengi
Mhuputa			**Sandala**=18 Mhuputa=0 Inachanua haraka, Haipukutiki shamabani	**Pato**=18 Mhuputa=0 Mazao ni mengi, Ugali/kande nzuri, Suke kubwa, Punje kubwa, Haibunguliwi sana, Nzuri kwa biashara, Ina pombe nzuri	**Mhuputa**=16 Lugugu=0 Inakomaa haraka, Ugali ni mtamu, Inastahimili ukame,	**P6**=18 Mhuputa=0 Inavumilia ukame, Nzuri kwa ugali na kande, Inakoboleka, Ina pumba kidogo,	**P5**=18 Mhuputa=0 Inachanua haraka, Inavumilia ukame, Ni fupi, Inatoa mazao mengi, Ugali na kande ni nzuri	**Lu. wa Arusha**=7 Mhuputa=8 NR =1 Ina mavuno mengi, Ugali ni mtamu, Kande ni nzuri, Inavumilia uakame, Inakomaa haraka, Haishambuliwi sana na stalk borers	**Bangala**=11 Mhuputa=6 Mazao mengi, Mbegu ni kubwa, Haishambuliwi sana na ndege, Haipukutiki, Ugali ni mtamu
Sandala				**Pato**=17 sandala=0 as above	**Sandala**=17 Lugugu=0 Inakomaa haraka, Inavumilia ukame, Haipukutiki shamabani	**P6**=16 Sandala=0 as above	**P5**=14 Sandala=2 as above	**Sandala**=17 Lug. wa Arusha= 0 Inakomaa haraka, Inavumilia ukame, Haipukutiki shamabani	**Sandala**=16 Bangala=0 Haihitaji mvua nyingi, Mavuno ni mengi

Pato					**Pato**=17 Lugugu=0 Mazao ni mengi, Ugali/kande nzuri, Suke kubwa, Punje kubwa, Haibunguliwi sana, Nzuri kwa biashara, Ina pombe nzuri	**P6**=10 Pato=5 Mavuno mengi, Pumba kidogo, Ni fupi, Mbegu ni kubwa, Inavumilia ukame, Inafaa kwa mvua za aina zote, Haibunguliwi kirahisi	**Pato**=11 P5=6 Inavumilia ukame, Wadudu kidogo, Inachanua haraka	**Pato**=17 Lug. wa Arusha =0	**Pato**=17 Bangala=0
Lugugu						**P6**=18 Lugugu=0 as above	**P5**=18 Lugugu=0 as above	**Lug wa Arusha**=11 Lugugu=? Huvumilia uakame, Kukomaa haraka, Ina punje kubwa	**Bangala**=16 Lug wa Arusha=1 Haishambuliwi sana na ndege, Inaiva haraka, Hustahimili ukame
P6							**P6**=13 P5=0 NR=2 Inachanua haraka, Mbegu ni kubwa, Suke ni kubwa, Inastahimili ukame	**P6**=15 Lug wa Arusha=0 Ugali ni mtamu, Suke ni kubwa, Inavumilia ukame, Haipukutiki kirahisi	**P6**=16 Bangala=1 Inachanua haraka, Mbegu ni kubwa, Suke ni kubwa, Inastahimili ukame
P5								**P5**=15 Lug wa Arusha=0 Inachanua haraka, Inavumilia ukame, Ni fupi,	**P5**=16 Bangala=0 Inachanua haraka, Inavumilia ukame, Ni fupi,

								Inatoa mazao mengi, Ugali na kande ni nzuri	Inatoa mazao mengi, Ugali na kande ni nzuri
Lugugu wa Arusha									**Lug wa Arusha**=11 Bangala=0 Mwepesi kuchanua, Haupukutiki kirahisi, Mavuno ni mengi, Unastawi hata kama ardhi na rutuba kiasi
Bangala									
	5	2	4	7	0	8	6	2	2
	4	6	5	2	9	1	3	6	6

Faida na Hasara ya kulima Mbaazi: Mkumi makulu (wanaume na wanawake)

Faida	Hasara
• Mboga wakati ikiwa mbichi na ikiwa kavu wakati wa kiangazi • Zao la biashara • Majani yakianguka ardhini huongeza rutuba • Mashina yake hutumika kama kuni • Ni rahisi kulima mchanganyiko na mazao mbalimbali • Unaweza ukavuna mara mbili • Huvumilia ukame • Dawa ya degedege na kuharisha	• Hushambuiwa na wadudu shambani • Hushambuliwa na wadudu ghalani

Appendix 1(d) CHIPANGA VILLAGE

Variety preference by criteria - Men in Chipanga

	Macia	Lugugu mpyaungu	pato	SRN39	P5	P6	Serena	Lugugu	Mtika	Hembahemba	Chigwala	Tegemeo	Sandala	Siga
Huvumilia uakame	1	12	5	7	2	4	6	13	8	10	9	3	11	14
Inakomaa haraka	1	12	7	6	2	3	4	13	9	11	8	5	10	14
Mazao mengi	4	9	1	3	10	14	11	7	6	12	8	2	5	13
Haishanbuliwi na wadudu	12	5	8	13	9	11	7	1	3	4	2	10	14	6
Inavumilia mavua nying	14	6	8	9	10	11	7	1	3	5	2	12	13	4
Inastahimili magonjwa	10	3	2	1	8	9	4	14	11	12	13	7	6	5
Haishambuliwi na ndege	11	9	12	8	6	7	1	10	3	5	2	13	14	4
Punje kubwa	8	3	2	6	5	7	10	11	12	13	14	4	9	1
Bei nzuri	13	2	7	11	8	12	14	1	3	5	4	9	10	6
Huvumila viduha	4	9	8	10	1	2	3	6	7	13	11	5	14	12
Ugali mzito	11	5	9	12	6	13	3	1	2	8	4	10	14	7
Kupiga ni rahis	11	2	6	9	10	6	13	1	4	14	3	7	8	5
Ugali mzuri	11	3	9	10	2	14	12	1	4	13	5	8	7	6
Pombe nzuri	9	11	2	6	1	8	5	12	13	3	14	4	7	10
Ugali mweupe	8	2	13	7	9	12	14	1	3	10	11	6	4	5
Miwa nzuri	10	13	5	8	9	11	6	14	4	1	12	7	2	3
JUMLA	134	106	104	126	98	144	120	108	94	139	122	102	148	115
Daraja la ubora	11	5	4	10	2	13	8	6	1	12	9	3	14	7
Overall raking	4	9	2	8	1	6	14	7	5	11	10	3	13	12

Sorghum Ulezi varietry was dropped by men as they thought to be less important in the village. Tegemeo although not displayed among the varieties brought by farmers was included in ranking as they thought to be important in the village.

Variety preference Pair-wise Ranking - Men in Chipanga

	Macia	Lugugu mpyaungu	Pato	SRN39	P5	P6	Serena	Lugugu	Mtika	Hembahemba	Chigwala	Tegemeo	Sandala	Siga
Macia		Macia	Pato	Macia	P5	Macia	Macia	Macia	Macia	Macia	Macia	Tegemeo	Macia	Macia
Lugugu mpyia			Pato	SRN39	P5	P6	Lugugu m	Lugugu	Mtika	Lugugu m	Chingwala	Tegemeo	Lugugu m	Lugugu m
Pato				Pato	P5	Pato	Pato	Pato	Pato	Pato	Pato	Tegemeo	Pato	pATO
SRN39					p5	srn39	srn39	SRN 39	SRN39	SRN39	SRN39	Tegemeo	SRN39	SRN39
P5						P5	P5	P5	P5	P5	P5	P5	P5	P5
P6							P6	P6	P6	P6	P6	Tegemeo	P6	P6
Serena								Lugugu	Mtika	HembaHemba	Chigwala	Tegemeo	Sandala	Siga
Lugugu									Mtika	Lugugu	Chigwala	Tegemeo	Lugugu	Lugugu
Mtika										Mtika	Mtika	Tegemeo	Mtika	Mtika
Hembahemba											Chigwala	Tegemo	H.hemba	H.hemba
Chigwala												Tegemeo	Chigwala	Chigwala
Tegemeo													Tegemeo	Tegemeo
Sandala														Siga
Siga														
JUMLA	10	4	11	9	13	8	0	5	7	3	6	12	1	2
Daraja la ubora	4	10	3	5	1	6	14	9	7	11	8	2	13	12

Aina zingine za Mtama unaolimwa Iteja ni:
Hamna

Explanation of Pair-wise ranking - Men in Chipanga

	Macia	Lugugu mpyaungu	Pato	SRN39	P5	P6	Serena	Lugugu	Mtika	Hembahemba	Chigwala	Tegemeo	Sandala	Siga
Macia		Macia Huvumilia ukame,	Pato Ladha nzuri, Mazao mengi	macia Bei ni nzuri, Ugali mzuri, Mazao mengi	P5 Ugali mzuri, Bei nzuri,	Macia Huvumilia ukame	Macia	Macia Hukomaa haraka, Mazao mengi	Macia Huiva haraka,	Macia Huiva haraka	Macia Hukomaa haraka	Tegemeo Ugali mtamu, Soko ni zuri, Huvumilia mvua nyingi	Macia Hukomaa haraka, Mazao mengi	Macia Huiva haraka, Mazoa mengi
Lugugu mpyia			Pato Huvumilia ukame, Ugali mtamu, Pombe nzuri, Nzuri kwa chapati	SRN39 Huiva haraka	P5	P6 Ugali mzuri, Mazao mengi	Lugugu m Ugali mweupe, Ugali mtamu	Lugugu Inapigika haraka Soko zuri	Mtika	Lugugu m Mtama mwingi	Chingwala Mwepesi kuiva, Haushambuliwi na ndege	Tegemeo	Lugugu m	Lugugu m
Pato				Pato	P5 Ugali mzuri, Unanukia kama uwele, Mazao mengi	Pato Ugali mzuri, Mazao mengi	Pato	Pato	Pato	Pato	Pato	Tegemeo Ugali mzuri	Pato	pATO
SRN39					p5 Ugali mzuri	srn39 Ugali mzuri, Inavumilia wadudu wa shambani	srn39	SRN 39	SRN39	SRN39	SRN39	Tegemeo	SRN39	SRN39
P5						P5	P5 Ugali mtamu, Ukipiga unatoka haraka, Pombe ni nzuri, Punje ni kubwa	P5 Ugali mzuri, Pombe ni nzuri	P5	P5	P5	P5	P5	P5
P6							P6	P6	P6	P6	P6	Tegemeo	P6	P6
Serena								Lugugu	Mtika Mwepesi kuiva, Nzuri kwa miwa	HembaHemba Ugali mzuri	Chigwala	Tegemeo	Sandala	Siga
Lugugu									Mtika	Lugugu Ugali mtamu	Chigwala	Tegemeo	Lugugu	Lugugu

Mtika										Mtika	Mtika	Tegemeo	Mtika	Mtika
Hembahemba											Chigwala	Tegemo	Hembahemba	Hembahemba
Chigwala												Tegemeo	Chigwala	Chigwala
Tegemeo													Tegemeo	Tegemeo
Sandala														Siga
Siga														
JUMLA	10	4	11	9	13	8	0	5	7	3	6	12	1	2
Daraja la ubora	4	10	3	5	1	6	14	9	7	11	8	2	13	12

Pair-wise Ranking - Women in Chipanga

	Selena	**Mgali**	**Masiga**	**Ulezi**	**P6**	**Sandala**	**CRN39**	**Chingwala**	**Pato**	**Rugugu**	**Mtika**	**P5**	**Uwelw**	**Okoa**
Selena		Mgali	Masiga	Selena	P6	Sandala	CRN39	Chingwala	Pato	Rugugu	Mtika	P5	Uwele	Okoa
Mgali			Masiga	Mgali	P6	Sandala	CRN39	Chingwala	Pato	Rugugu	Mtika	P5	Uwele	Okoa
Masiga				Masiga	Masiga	Masiga	Masiga	Masiga	Masiga	Rugugu	Masiga	Masiga	Uwele	Okoa
Ulezi					P6	Sandala	CRN39	Chingwala	Pato	Rugugu	Mtika	P5	Uwele	Okoa
P6						Sandala	CRN39	Chingwala	P6	Rugugu	Mtika	P6	Uwele	Okoa
Sandala							CRN39	Chingwala	Pato	Rugugu	Mtika	P5	Uwele	Okoa
CRN39*								Chingwala	Pato	Rugugu	Mtika	P5	Uwele	Okoa
Chingwala									Chingwala	Rugugu	Mtika	P5	Uwele	Okoa
Pato										Rugugu	Mtika	Pato	Uwele	Okoa
Rugugu											Rugugu	P5	Uwele	Okoa
Mtika												Mtika	Uwele	Okoa
P5													Uwele	Okoa
Uwele+														
Okoa**														
Jumla	1	2	10	0	5	4	5	7	6	10	9	7	12	12
	12	11	2	13	8	10	8	5	7	2	4	5	1	1

Table Ranking of varieties by farmer criteria- Wanawake, Chipanga

	Vigezo	Selena	Mgali	Masiga	Ulezi	P6	Sandala	CRN39	Chimgwala	Pato	Rugugu	Mtika	P5	Okoa*
Muhimu sana	Inavulimia ukame	5	8	8	8	1	6	3	8	3	8	8	1	7
	Mavuno mengi	5	7	6	12	3	6	4	9	1	9	11	2	12
	Hukomaa haraka	1	8	8	8	1	1	1	3	6	8	8	1	6
	Kukoboa rahisi	9	12	2	13	6	9	6	4	9	2	4	6	1
Muhimu	Ukikoboa unga mweupe	11	10	1	13	7	1	8	1	9	1	1	6	12
	Pumba kidogo	12	11	5	13	8	9	7	4	6	2	3	10	1
	Ugali mweupe	11	10	1	13	7	5	8	3	9	2	4	6	12
	Ugali mzuri	12	11	3	13	7	8	10	4	9	2	5	6	1
	Ugali mzito	12	10	4	13	7	9	11	6	8	2	3	5	1
	Ugali mtamu	11	5	4	13	7	10	7	6	9	2	3	7	1
Muhimu kidogo	Pombe mzuri	5	4	11	3	7	6	9	11	2	11	10	8	1
	Kwa biashara	9	8	10	1	7	6	5	10	4	10	10	3	2
Project criterion	Inavulimia viduha	6	2	2	?	5	4	3	-	2	-	-	1	1
All criteria		103	104	63	123	68	76	79	69	75	59	70	61	57
		11	12	4	13	5	9	10	6	8	2	7	3	1
Important and very important criteria		89	92	42	119	54	64	65	48	69	38	50	50	54
		11	12	2	13	6	8	9	3	10	1	4	4	6
Very important criteria		20	35	24	41	11	22	14	24	19	27	31	10	26
		5	12	7	13	2	6	3	7	4	10	11	1	9

*Note: Okoa is a pearl millet variety

Strength and weaknesses of intercropping- Men Chipanaga

Faida	Hasara
• Mazao ya aina nyingi hupatikana. • Unapata mazao mawili kwa wakati mmoja	• Kama umepanda kunde na mtama kunde hubana mtama • Ukipanda mtama na karanga siku moja karanga hazizai

Strength and weaknesses of applying farm yard manure (Samadi) - Men Chipanga

Faida	Hasara
• Mazao mengi kama kuna nvua ya kutosha • Mazao yanakua kwa haraka zaidi • Viduha vinapungua • Udongo unalainika	• Kama mvua ni ndogo mimea inakauka haraka • Mvua ndigo husanabaisha wadudu wengi • Mgugu huongezeka (Ngombe hula mimea tofauti) • Kubeba mbolea ni kazi kubwa

Strength and weaknesses of intercropping- Women Chipanaga

Faida	Hasara
• Kupata mazao mawili katika eneo moja • Hurutubisha udongo (Mtama na karanga). • Masuke makubwa iwapo nafasi itakuwa kubwa • Kipato zaidi iwapo utapanda karanga na njugu mawe • Mazao mengi iwapo utapalilia mapema	• Huwezi ukapata zao la njugumawe iwapo utapanda na mtama, • Eneo lazima liwe kubwa (eneo kubwa hutumika) • Masuke yanakuwa madogo iwapo utapanda kwa nafasi ndogo • Kipato kidogo kama hutapalilia mapema • Mazao mashina membamba • Inategemea aina ya mtama mfupi/mrefu - mrefu si rahisi kuchanganya

Strength and weaknesses of applying farm yard manure (Samadi) - Women Chipanga

Faida	Hasara
• Hustawisha mazao kwenye ardhi ya kichanga • Masuke makubwa • Ngogomba usipoweka mbolea unapata mazao mengi ????? • Nkuluhi ukiweka sanadi unapata mazao mengi • Mazao mengi kwenye karanga ukiweka samadi	• Mtama unakauka ukiweka mbolea • Wadudu hula lashina (mchwa) • Kwenye Ngogomba wadudu hutokea • Ilolo ukiweka mbolea hupati mazao • Kichanga usipoweka mbolea hupati mazao mengi iwapo mvua ni kidogo • Magugu mengi ukitumia (suji???)

Appendix 3 Farmers' criteria for sorghum variety ranking in study villages in Misungwi and Dodoma rural districts

	Misungwi district				Dodoma Rural district				
	Mwagala Men	Mwagala women	Iteja men	Iteja women	Mvumi men	Mvumi Women	Chipanga men	Chipanga women	Total
Ability to withstand drought	1	1	1	1	1	1	1	1	8
Quicker maturity	1	1	1	1	1	1	1	1	8
Higher yields/ Larger heads	1	1	1	1	1	1	1	1	8
Less easily attacked by birds	1	1	1	1	1	1	1		7
Ease of marketing	1	1	1	1		1	1	1	7
White colour grain and flour	1	0	1	1	1	1	1	1	7
Better taste	0	1	1	1	1	1		1	6
Less easily attacked by pests(field)	1	1	0	1		1	1		5
Ability to withstand striga	1	1	1				1		4
Less easily attacked by diseases	1	1	0	1			1		4
Ease of de-hulling	0	0	0	1	1	1		1	4
Suitability for local brew					1	1	1	1	4
Larger grain size	0	1	0	0	1		1		3
Less easily attacked by store pests	0	0	1	0	1	1			3
Reducing feeling of hunger/heavy ugali					1		1	1	3
Little pumba/ chaff /husk					1	1		1	3
Better rate of germination	0	1	0	1					2
Suitability of stems for building	1	0	0	0	1				2
Smoothness of ugali	1	0	0	0					1
Many grains per head	0	1	0	0					1
More nutritious	0	1	0	0					1
Less weeding frequency	0	0	0	1					1
Ease of threshing	0	0	0	1					1
Short plants					1				1
Not shattering					1				1
Cooking sorghum bread						1			1
Pop sorghum						1			1
Eat like sugar cane							1		1
Withstand heavy rain							1		1

Appendix 4 Comparison of five modern sorghum varieties by pairwise ranking results from seven farmer groups

	Mwagala Men	Mwagala women	Iteja men	Iteja women	Mvumi men and women	Chipanga men	Chipanga women
P5 v P6	P6	P6	P5	P5	P6	P5	P5
P5 v Pato	P5	PATO	PATO	P5	PATO	P5	PATO
P5 v Macia	MACIA	MACIA	MACIA	MACIA	NR	P5	NR
P5 v SRN39	P5	P5	P5	P5	NR	P5	P5
P6 v Pato	PATO	P6	PATO	P6	P6	PATO	P6
P6 v Macia	MACIA	MACIA	MACIA	MACIA	NR	MACIA	NR
P6 v SRN39	P6	P6	P6	P6	NR	SRN39	SRN39
Pato v Macia	MACIA	MACIA	PATO	MACIA	NR	PATO	NR
Pato v SRN39	PATO	PATO	PATO	PATO	NR	PATO	PATO
Macia v SRN39	MACIA	MACIA	MACIA	MACIA	NR	MACIA	NR

NR = Not reported

Comparison of five modern varieties by pairwise ranking results from seven farmer groups

	P9405	P9406	Pato	Macia	SRN39
P9405	#	P5=4; P6 =3	P5 = 3; Pato=4	P5=1; Macia=4; NR=2	P5=6;NR=1
P9406	#	#	P6=4; Pato=3	Macia = 5; NR =2	P6=4;SRN=2;NR=1
Pato	#	#	#	Macia = 3; Pato =2; NR =2	PATO=6;NR=1
Macia	#	#	#	#	MACIA=5;NR=2
SRN39	#	#	#	#	#
Total	2	2	2	4	0

Appendix 5 Farmer ranking of modern sorghum varieties by some important farmer criteria in study villages in Misungwi and Dodoma rural districts

	P5								**P6**								**SRN39**								PATO							
	MW	MM	IW	IM	MKB	CW	CM	MEAN	MW	MM	IW	IM	MKB	CW	CM	MEAN	MW	MM	IW	IM	MKB	CW	CM	MEAN	MW	MM	IW	IM	MKB	CW	CM	MEAN
Ability to withstand drought	5	1	2	2	1	1	2	2	3	2	3	3	1	1	4	2	5	3	4	7	NR	3	7	5	10	2	7	11	3	3	5	6
Quicker maturity	1	1	2	7	1	1	2	2	1	1	3	8	2	1	3	3	7	2	4	9	NR	1	6	5	3	2	5	3	4	6	7	4
Higher yields/ Larger heads	5	3	2	2	3	2	10	4	3	2	3	3	2	3	14	4	4	3	5	5	NR	4	3	4	1	1	4	1	1	1	1	1
Less easily attacked by birds	5	2	5	4	9	NR	9	6	4	2	4	5	8	NR	7	5	6	2	3	9	NR	NR	8	6	9	5	7	11	7	NR	12	9
Ease of marketing	2	2	4	2	5	3	8	4	2	2	5	3	6	7	12	5	5	3	9	5	NR	5	11	6	4	1	1	1	5	4	7	4
White colour grain and flour	NR	2	4	5	NR	NR	NR	4	NR	2	5	4	NR	NR	NR	4	NR	2	6	2	NR	NR	NR	3	NR	1	3	3	NR	NR	NR	2
Better taste	5	NR	2	3	5	7	NR	4	3	NR	5	4	6	7	NR	5	4	NR	6	5	NR	7	NR	6	1	NR	3	1	8	9	NR	4
Less easily attacked by pests(field)	5	2	2	NR	8	NR	9	5	4	2	3	NR	7	NR	11	5	5	2	4	NR	NR	NR	13	6	1	5	7	NR	9	NR	8	6
Ability to withstand striga	2	1	2	1	1	1	1	1	2	1	3	2	2	5	2	2	6	2	4	4	NR	3	10	5	10	3	5	11	3	2	8	6
Less easily attacked by diseases	9	1	2	NR	NR	NR	8	5	6	1	3	NR	NR	NR	9	5	7	2	4	NR	NR	NR	1	4	10	4	7	NR	NR	NR	2	6
Ease of de-hulling	NR	NR	NR	NR	8	6	NR	7	NR	NR	NR	NR	7	6	NR	7	NR	NR	NR	NR	NR	6	NR	6	NR	NR	NR	NR	6	9	NR	8
Suitability for local brew	NR	NR	NR	NR	NR	8	1	5	NR	NR	NR	NR	NR	7	8	8	NR	NR	NR	NR	NR	9	6	8	NR	NR	NR	NR	3	2	2	2
Mean rank/ score	4	2	3	3	5	4	6	4	3	2	4	4	5	5	8	5	5	2	5	6	0	5	7	5	5	3	5	5	5	5	6	5
	P5								**PATO**								**MACIA**								**OVERALL**							
	MW	MM	IW	IM	MKB	CW	CM	MEAN	MW	MM	IW	IM	MKB	CW	CM	MEAN	MW	MM	IW	IM	MKB	CW	CM	MEAN	P5	P6	SRN39	PATO	MACIA	MEAN		
Ability to withstand drought	5	1	2	2	1	1	2	2	10	2	7	11	3	3	5	6	4	1	1	4	NR	NR	1	2	2	2	5	6	2	4		
Quicker maturity	1	1	2	7	1	1	2	2	3	2	5	3	4	6	7	4	5	1	1	5	NR	NR	1	3	2	3	5	4	3	3		
Higher yields/ Larger heads	5	3	2	2	3	2	10	4	1	1	4	1	1	1	1	1	7	1	1	4	NR	NR	4	3	4	4	4	1	3	3		
Less easily attacked by birds	5	2	5	4	9	NR	9	6	9	5	7	11	7	NR	12	9	8	2	6	8	NR	NR	11	7	6	5	6	9	7	6		
Ease of marketing	2	2	4	2	5	3	8	4	4	1	1	1	5	4	7	4	1	2	3	6	NR	NR	13	5	4	5	6	4	5	5		
White colour grain and flour	NR	2	4	5	NR	NR	NR	4	NR	1	3	3	NR	NR	NR	2	NR	2	2	1	NR	NR	NR	1	4	4	3	2	1	3		
Better taste	5	NR	2	3	5	7	NR	4	1	NR	3	1	8	9	NR	4	8	NR	1	2	NR	NR	NR	4	4	5	6	4	4	5		
Less easily attacked by pests(field)	5	2	2	NR	8	NR	9	5	1	5	7	NR	9	NR	8	6	8	2	1	NR	NR	NR	12	6	5	5	6	6	6	6		
Ability to withstand striga	2	1	2	1	1	1	1	1	10	3	5	11	3	2	8	6	8	1	1	3	NR	NR	4	3	1	2	5	6	3	4		
Less easily attacked by diseases	9	1	2	NR	NR	NR	8	5	10	4	7	NR	NR	NR	2	6	4	2	1	NR	NR	NR	10	4	5	5	4	6	4	5		
Ease of de-hulling	NR	NR	NR	NR	8	6	NR	7	NR	NR	NR	NR	6	9	NR	8	NR	NR	NR	NR	NR	NR	NR	NR	7	7	6	8	NR	7		
Suitability for local brew	NR	NR	NR	NR	NR	8	1	5	NR	NR	NR	NR	3	2	2	2	NR	NR	NR	NR	NR	NR	9	9	5	8	8	2	9	6		
Mean rank/ score	4	2	3	3	5	4	6	4	5	3	5	5	5	5	6	5	6	2	2	4	0	0	7	4	4	5	5	5	4			

Key: MW = Mwagala women; MM = Mwagala men; IW = Iteja women; IM= Iteja men; MKB= Mvumi Makulu women and men; CW = Chipanga women; CM = Chipanga men.