ACHIEVEMENTS IN 2004 SEASON ON PROMOTION OF GREEN MANURE TO INCREASE SOIL FERTILITY AND CONTROL OF *STRIGA* IN KYELA AND MATOMBO DISTRICTS - TANZANIA

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COVER PAGE:
Rice crop severely infested by *Striga asiatica* – Itope, Kyela. March 2004

Preface

Striga species, the parasitic witchweeds, are widespread in small holder crops in semi-arid and sub-tropical regions of Eastern and Southern Africa. These weeds attack and reduce the yield of maize, sorghum, upland rice and finger millet in these regions. In many areas it is the crops of resource-poor households, which are particularly affected. They impose additional stress with which farmers, who have little resources for investments in crop production, have to cope in an environment characterised by marginal rainfall for cropping and declining soil fertility. Since 1996 staff from the Department of Agricultural Research, Sokoine University of Agriculture and district council agricultural extension teams in Tanzania and, Natural Resources Institute in UK have collaborated to develop integrated *Striga* management practices for the rice crop. Studies have been undertaken with groups of rice farmers in Kyela district, in Mbeya Region and Matombo, in Morogoro Region of Tanzania.

Through on-farm trials farmers came to appreciate that poor rice production is associated with *Striga* and that this is an indicator of low soil fertility. This in turn is a consequence of continuous rice cultivation in the absence of using any fertilizer or manure. While the field trials demonstrated that up to a 60% reduction in *Striga* numbers and a 40% increase in rice yield can be achieved by using urea, farmers decided they did not wish to invest scarce cash in inorganic fertilizer. Instead they became interested in the opportunity, also observed from the field trials, to improve rice productivity on *Striga* infested soils by planting the green manure crop *Crotalaria.*

The current project on "*On-farm verification and promotion of green manure for enhancing upland rice productivity on Striga infested fields in Tanzania*" (October 2002 to March 2005) aims to scale up demonstration of using the green manure in rotation with rice in both Kyela and Matambo Districts.

The purpose of this report is to outline findings from activities undertaken during 2004 including a mid-season group evaluation of demonstration plots, farmer exchange visit and farmer field days conducted in both Kyela and Matombo and, yield results from the 2004 rice harvest.

Further information on the project or further copies of previous reports are obtainable from:

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On-farm verification and promotion of green manure for enhancing upland rice production on Striga infested fields

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Introduction

Plots of pigeon pea, *marejea* (*Crotalaria ochroleuca*), and rice (or maize at some sites in Matombo) were planted at 81 sites during the 2004 crop season. The total number of active group members exposed to the technologies this season is more than 100. With field days in each district in June, and day to day viewing of plots by neighbors, family and friends, the demonstration effect of the on-going demonstrations has been considerable. Table 1 shows the scale of activity in the six participating villages.

Kyela District

Kilasilo and Itope villages:

- No seed of either *Marejea* or pigeon pea was distributed to farmers by the project for this season in Itope or Kilasilo in Kyela. The farmer groups in these villages are now well established with increasing numbers of farmers and size of plots leading to greater seed availability each season. Indeed the project purchased considerable quantities of *marejea* seed from these villages in 2003 for distribution elsewhere.
- In Kilasilo the group is now registered with a constitution and has started a limited programme of seasonal loans to members using a fund established from entry and member ship fees. The group chairman said “our group has matured and has given a child – a savings and credit society”.
- With continuing support from an active village extension officer and the district office both villages are now “self sufficient” in seed and the communities have gained considerable knowledge and experience in growing and using *marejea* and pigeon pea. The value of these crops to reduce *Striga* infestation, increase soil fertility and rice yield is increasingly widely understood.
- Here as elsewhere farmers repeatedly mention that following a crop of *marejea* they only have to weed rice once instead of the usual twice or even three times for field under continuous rice. This is a further factor that makes the use of *marejea* popular with farmers.
- Group members are internalizing the rice/legume rotational practice within their cropping systems. As one farmer with more than 0.5 acres of *marejea* put it “other farmers laugh at the size of our plot but when they see the rice yield next season it will be us who are laughing”. Another farmer, now growing *marejea* for the third season, has planted two plots of over 0.5 acres for fertility improvement this season. In addition he has inter-planted cassava plots, and probably less advisably sweet potato plots, as part of his on-going seed multiplication exercise.
- Farmers have observed that good results can be achieved by either incorporating *marejea* biomass or using it as mulch. The green manure only has a beneficial effect on the subsequent rice crop however so farmers need to rotate rice and *marejea* in alternate years.

- There would now seem to be sufficient plots of the legumes scattered throughout the lands of these communities to provide a significant demonstration effect. Most participants report being asked for seed by other farmers.
- When new farmers first plant *marejea* their strategy is to secure a future seed supply by on-farm multiplication. Ideas for accelerating adoption were discussed with the farmer groups.
- One idea to be explored further is for the group in Kilasilo to set up a “shop” at the local hospital where farmers can sell seed and where information on *Striga* management and green manuring will be made available.
- The meeting in Kilasilo was attended by the Ward executive officer and a district councilor. They commented that they learnt far more than they had expected and now want to spread the technology in their villages as well.

Sinyanga:

The group with 13 members is now in its second year. After a visit to Itope and Kilasilo last year members are concentrating on building up *marejea* and pigeon pea seed supplies on demo plots this season.

- Based on what they had seen elsewhere, one family had expanded *marejea* to 0.6 acres of land in only the second year they have been growing the crop.
- Initially other villagers had said that group members were “crazy to plant weeds” but now increasing numbers of farmers are asking for seed. One group member said “we are giving our research plots priority so other farmers will see the results”.
- The 13 farmers with plots in Sinyanga will produce plenty of *marejea* seed this season to allow expansion of the number of farmers trying and adopting legume/rice rotation.
- There has been little uptake of the pigeon pea cultivar offered to farmers by the project. Some said this was because seed was delivered too late. In further discussion group members indicated that the crop does not do well when soil moisture is high and that they would rather plant it on their highest fields on ridge tops above the flood plain rather than on rice fields lower down. Suggested that in 2005 they try the new wilt resistant cultivar as an inter-crop in maize on sandy soils.
- So far few women are participating in the group. One man indicated that wives of group members stay at home “because we have not sensitized them” and therefore women have not been able to learn the concept behind the research. Another said “better we admit we did not give a chance to our wives and other women to attend group meetings…we were not lazy, just we did not want to involve them”. It was agreed to make more effort to involve women in the future.
- Farmers said that they need to make their own plots a success and then by demonstration, discussion of results at village meetings and providing *marejea* seed from their fields, others can be encouraged to try the technology.

Konjula:

There is currently less success in Konjula where the group was also formed in 2003. There were 17 members but some farmers who participated initially have left and now there are only 9 in the group. There may be a problem of leadership although the village chairman is a group member. Another possibility is that *Striga* is not such an issue in the village. As the project approach has been to present the legume/rice rotation as a practice to reduce *Striga* the message may not have been as clearly relevant here as elsewhere. Much of the village "upland" lies along a transition zone with wetter lowland. This is not an area that farmers are prepared to grow pigeon pea as this is usually grown on free draining soils near to houses at the top of slopes. It was suggested that in 2005 the new cultivar of pigeon pea is planted as an inter-crop in maize. Despite these problems there is a core of farmers with plots who wish to continue and who also want to convince other farmers to grow the legumes.

Rock phosphate

Soil analysis has indicated that the floodplain soils in Kyela are acidic and deficient in phosphorus. Rock phosphate, mined in northern Tanzania, is now available on the market so trials were undertaken in both Itope and Kilisilo in 2004 to evaluate its effect on rice. Rock phosphate plots were superimposed on farmers plots (see site descriptions in Table 2). Few clear, consistent effects were seen at the dose used. Farmers suggested that more detailed trials should be undertaken on their fields by Uyole Research Institute on the phosphate issue. The Zonal Research Coordinator from Uyole attended the group meeting at Kilasilo. He indicated that he would consider the farmers' request with his staff.

Morogoro rural District

Kiswira and Kibangile villages

Following the exchange visit to see demo plots in Kyela in 2003, farmers in the Kiswira and Kibangile groups in Matombo are embracing the evaluation of the legumes with considerable enthusiasm. The area was hit by drought in 2003, the first year farmers worked with the project, so growth of the few legume plots that were established was generally poor.

- Despite this subsequent rice and maize at a number of sites has performed far better than on plots in continuous cereal cultivation and higher yields are expected. This and experience gained when visiting Kyela has convinced a number of farmers of the benefits of adopting the legume/rice rotation. One lady in Kiswira for example complained about the need to have a continuous cereal plot to compare with land under rotation. She pointed out that she knows her land is infertile so "as it is useless let me improve it!"
- Pigeon pea is already a popular crop in Matombo grown as scattered plants, not as a row planted field–scale crop. Participating farmers are most impressed with growing the new variety in this way.
- In both villages farmers describe how the worst *Striga* infestations are in rice on the higher mountain slopes. At present, demo plots are on more accessible lower slopes, often used for maize as well as rice. The strategy of many participants is to use lower altitude fields, which are also near to home, to multiply *marejea* seed which they will plant on higher rice lands next season. Both *S. asiatica* and *S. forbesii* infest these fields.
- Farmers are interested in planting pigeon pea as as an inter-crop as well spaced rows in either maize or rice.

- Group members have identified that planting date is the critical issue for good biomass production by *marejea*. Most farmers planted in early February and have excellent crops. Farmers have therefore learnt that it is important to plant early in the long rains. Also suggested that if maize is planted on *vuli* rain then *marejea* can be planted as relay crop in February on the same plot.
- Both groups requested more seed as they know of many farmers wishing to adopt the legume-cereal rotation.
- To ensure continued dissemination of the practice it was suggested to use church meetings to inform other farmers about the practice.

Table 1. Summary of situation with on-farm plots in Kyela and Matombo, May 2004

Village	**Sites**	**Comments**
Kyela District		
Kilasilo	22	Group started with 2 members in 1998 and now there are 26 members. Some participants now planting *Marejea* for the third season. Up to 0.6 acres *Marejea* being grown per farmer. No seed was provided by the project last season of either *Marejea* or pigeon pea. Farmers are focused on maintaining own seed supplies and expanding participation by giving or selling seed to others. The group now has a constitution and had started providing small cash loans to members.
Itope	10	The group was founded by 2 farmers in 1998 and now has 28 members. Some participants have *Marejea* for third season but most are planting for 1st or 2nd time. A number have moved away from evaluation to incorporating the green manure into their rotation with 0.2 to 1.5 acres *Marejea* per farm. Increasing demand in village for seed.
Sinyanga	13	The group formed in 2003 now has 13 members. *Marejea* plots vary from less than 0.1 to 0.6 acre. New participants keen to save seed this season to expand area under green manure next season.
Konjula	8	This group is less organised than in other villages and individuals have given less attention to plots than elsewhere. Members are mix of those who were involved last year and new participants. Leadership weak. *Marejea* plots vary in size from less 0.1 to 0.16 acre.
Matombo District		
Kiswira	12	12 members with pigeon pea and *Marejea* plots including 3 whom are new to the demos. Considerable enthusiasm among group following exchange visit to Kyela last season. Pigeon pea growing well on lower slopes near to houses where farmers will rotate with maize. Farmers particularly interested in growing *Marejea* on higher mountain slopes where rice is the main crop and *Striga* is a serious problem. Current strategy is to multiply *Marejea* on lower fields for use next season at higher altitude
Kibangile	16	16 group members, plans to expand to 25 next season. Similar enthusiasm to Kiswira following exchange visit of some group members to Kyela in 2003. Pigeon pea and *Marejea* plots 0.05 to 0.07 acres. Farmers concentrating on multiplying seed this season but will follow with rice or maize to test effect on fertility in 2005. Many farmers in village asking for seed.

Table 2a: Kiswira village – Morogoro Rural District

Farmer	**Plots planted**	**Comments**
George Mkami (Group chairman)	Local maize after *Marejea* *Marejea* planted 16/2 Pigeon pea planted 16/2 "Kiraka" planted 19/2	Second season involved with the project. *Marejea* stand was poor in 03 so little improvement to subsequent to maize crop in 04. Maize badly affected by streak. This season *Marejea* is very vigorous, farmer had pulled some weeds after the crop had emerged but then no weeding. Few weeds could bee seen on the plot. Also planted a smaller *Marejea* plot for seed. Kiraka took over two months to germinate so plot was re-planted in the interim with cowpea and sweet potato. Some kiraka seedlings now visible among cowpea.
Otto Mzeru	Maize after *Marejea* or pigeon pea. *Marejea* planted 6/2 Pigeon pea planted 6/2	Second season involved with the project. Although *Marejea* stand was poor in 03 maize following this or pigeon pea in 04 has larger cobs AND has less *Striga* compared to continuous maize. Excellent stand of *Marejea* now head high and flowering BUT considerable flower bud abortion.
Albatina Thomas	Maize after *Marejea* or pigeon pea. *Marejea* planted 2/2 Pigeon pea planted 2/2	Second season involved with the project. Farmer pointed out improvement in maize vigour and less *S. asiatica* following *Marejea* or pigeon pea. Indeed she indicated that she does not want to continue with a control plot of continuous maize – "the land here is exhausted and will not produce much so let me improve it". Current seasons plots of *Marejea* and pigeon pea both excellent.
Michael Roman	*Marejea*, pigeon pea and maize planted 26/1	First season involved with the project. Planning to grow maize after green manure. Will wait until *Marejea* produces seed before burying plants in trenches on this steeply sloping field. Last year there was a lot of *Striga* in maize here but this year there is less on an area where maize follows pigeon pea – not part of trial. Tried to grow *Marejea* in vuli rain but it grew poorly.
Constantine Anthony	*Marejea*, pigeon pea planted 20/3 and TMV1 maize	First season involved with the project. *Marejea* is at knee high and excellent stand. This plot was planted near to the road in response to request from VEO. His other field is far away and heavily infested by *Striga*. There he has good plots of pigeon pea and *Marejea* but the maize is growing poorly – also a serious streak infection.

Table 2a: Kiswira village – Morogoro Rural District cont.

Farmer	**Plots planted**	**Comments**
Germaina Peter	*Marejea*, pigeon pea and maize planted 5/2	First season involved with the project. Excellent legume crop stands with both *Marejea* and pigeon pea now above head height. Some *Striga* in maize.
Lydia John	*Marejea*, pigeon pea and maize planted 2/1	First season involved with the project. Excellent legume crop stands with both *Marejea* and pigeon pea very vigorous. Also has plot of Mwangulu rice provided by farmers from Kyela during exchange visit in 03.
Cyril Henry	*Marejea*, pigeon pea and maize planted 4/3	First season involved with the project. Vigorous dense stand of *Marejea* now waist high. Farmer plans to collect seed to use on rice field higher up in hills where *Striga* is a major problem.
Antonia Anthony	*Marejea*, pigeon pea and maize planted February (farmer not present)	First season involved with the project. Crops, including *Marejea*, rather weedy here. Maize looks unweeded. Pigeon pea was weeded late and is now ”thin” reflecting competition.
Paulo Matei	*Marejea*, pigeon pea planted 26/2.	First season involved with the project. Borrowed land in order to be involved with group to try legumes. Suggested it would be good to inter-crop maize in pigeon pea which grows slowly.
Isdory Malini	*Marejea*, pigeon pea and TMV1planted 2/2.	Second year involved with project and has good crop of maize following *Marejea* with big cobs.
Daudi Mdachi	*Marejea*, planted 10/2, pigeon pea and maize planted 5/2	First season involved with the project. All crops growing well; *Marejea* no flowering.

Table 2a: Kibangile village – Morogoro Rural District

Farmer	Plots planted	Comments
Filbert Roman	Rice after *Marejea* or pigeon pea; rice after rice, *Marejea* and pigeon pea all planted 21/2	Second year involved with project, plots on dark soil in valley bottom. Seed was harvested from *Marejea* last year and now followed by rice. Last season pigeon pea harvest was 2.5 kg from 10 m^2. Rice growth after *Marejea* better than continuous rice and with reduced *Striga* (7 plants per m^2 compared to 5 after pigeon pea and 13 in continuous rice). Growing Mwangulu rice cv ex Kyela which farmer says is tolerant to *Striga*. This year has planted *Marejea* on plot of 41 x 7 m. Mentioned that a neighbour wants to buy *Marejea* seed from him for next year.
Jumanne Rashidi	Maize after *Marejea* or pigeon pea, continuous maize. *Marejea* and pigeon pea planted 22/02.	Second year involved with project. Maize vigour and cob size better after pigeon pea or *Marejea* even though stands of legumes poor last season. This season planted *Marejea* on 6 x 35 m – excellent stand. Requested 10 kg *Marejea* seed so he can plant large area next season. Will follow this with rice on higher field where he has given up the crop as growth so poor.
Josephine Amos	Rice planted 1/1; pigeon pea 15/2 and *Marejea* 4/3	Second year involved with project. Harvested 7kg of maize TMV1 from 75 m^2 grown in vuli season after *Marejea* grown on long rains. All this season plots are 10 x 30 m.
Abdul Ali	*Marejea* (4 x 15 m); pigeon pea (small strip) both 12/3 Maize replanted 19/4	First season involved with the project. *Marejea* now waist high. Shady area under citrus on black soil in valley. Maize very poor (GLS?). Borrowed plot from mother for trial – no *Striga* observed in a rice plot here.
Angelica Aloyce	*Marejea* (6 x 20) Re-planted pigeon pea Rice	Second year involved with project. *Marejea* good biomass and now flowering. *Marejea* seed was saved from last season from another field on loan from village. This was taken back. *Striga* already uprooted in rice that is heavily infested here. Observed much *S. asiatica* and *S. forbesii* in rice and sorghum fields around area.
Stephania John	Rice after *Marejea*, pigeon pea, *Marejea* planted 16/2.	Second year involved with project. Saved own *Marejea* seed for use this year. Rice after *Marejea* looks very good and farmer says is more vigorous with less *Striga* than in past. Much *Striga* seen in other rice plots here. Has rice/pigeon pea mixed crop as well.
Hadija Salum	*Marejea*, pigeon pea and rice planted 6/2	First season involved with the project. Plots well managed with vigorous *Marejea* and pigeon pea. Lady joined project having seen plots elsewhere last season.
Halim Ramadhan	*Marejea* and pigeon pea (10 x 15m) planted 6/1.	First season involved with the project. Site very high up steep mountain side. Cleared from bush 15 years ago. Farmer says site too dry for rice so grows sorghum. Some *Striga* here but she would like to grow maize. Will save *Marejea* seed and use on rest of field next season.
Mseru Mbumku	*Marejea*, pigeon pea and rice planted 10/1.	First season involved with the project. Primary school teacher, *Marejea* weeded once and not quite as good as elsewhere. Pigeon pea weed twice and excellent – best plot in village. Rice has been weeded three times – part re-planted due to army worm. Valley site on black soil below school.
Primary school	*Marejea*, pigeon pea and maize	Plots planted at back of school buildings. Well managed with *Marejea* and pigeon pea looking vigorous.

Table 3a Konjula village – Kyela, mid-May 2004

Farmer	Plots planted	Comments
Jackson Salim	Rice after *Marejea* planted 20/1; *Marejea* and pigeon pea after fallow 20/4	Group chairman. Second year involved with project. Rice after *Marejea* taller than continuous rice and farmer expects more yield. Estimates he will harvest 40 kg rice when on same area in past he would get 4 kg. Scattered *S. forbesii* here. Continuous rice weeded twice but only one weeding for rice after *Marejea*.
Robert Mwailubi	*Marejea* after fallow (40 x 10 m)	Second year involved with project. Already harvested maize grown after *Marejea*; the maize yield was twice that of continuous maize. Weeded maize in rotation once and continuous maize twice. This year will keep half *Marejea* plot for seed.
Andrew Mwakasege	Rice after *Marejea*, continuous rice, *Marejea* planted 31/1	Second year involved with project. Due to death in family plots not well managed. Some of rice following *Marejea* not weeded at all. Hard to compare performance of rice plots due to weeds. This season's crop of *Marejea* excellent vigour and biomass, now flowering.
Jacob Mwaijabela	*Marejea* planted in March	First season involved with the project. *Marejea* knee high with few weeds. Learnt about green manures at village seminar. Says field is *Striga* infested.
Isakwisa Ndile Mwakijolele	*Marejea* 45 x 15 m	First season involved with the project. Field on edge of cocoa farm on sandy ridge above flood plain. This is usually used for cassava and groundnut. Farmer placed *Marejea* here for seed production. Grows rice elsewhere. Not very sure about how to use *Marejea*. Planted pigeon peas on patch among bananas but not for rotation with cereals.
Phane Kalenga	Pigeon pea and rice planted early February.	First season involved with the project. Good stands but rice (cv. Kilombero) rather yellow. He is interested in legumes for soil fertility improvement NOT to control *Striga* which is not much of a problem here. Did not plant *Marejea* due to illness.

Table 3a Sinyanga village – Kyela, mid-May 2004

Sinyanga village – Kyela District		
Farmer	**Plots planted**	**Comments**
Bosco Njetile	Rice after *Marejea*; new *Marejea* (15 x 25m) planted 15/01	Second year involved with project. Rice after *Marejea* is taller than continuous rice and farmer expects higher yield. This season *Marejea* excellent stand now with green pods. Farmer did not take pigeon pea seed as field is subject to water logging.
Israel Mwaijande	Pigeon pea and *Marejea* (8 x 30 m) planted 05/01.	First season involved with the project. Last season grew maize and groundnut on demo field, near to house, but was *Striga* infested so decided to test green manures. Stands of both *Marejea* and pigeon pea excellent; weeded once. Intends to save *Marejea* to use next year on rice field.
Abraham Mwakalinga	Pigeon pea and *Marejea* planted 05/03 (mixed), local pigeon pea and maize	First season involved with the project. He had small plots on dark upland soil. Legumes on area of maize last season. Wants to improve soil for rice. Is planting sweet potato on high amounts as farmer thinks this will reduce *Striga*. Did not take pigeon pea from the project.
Asanjenie Mtawa	*Marejea* planted February.	First season involved with the project. On poor light sandy soil. Pigeon pea not planted due to late receipt of seed. *Marejea*, planted after cassava now flowering, vigorous.
White Mwansansu	*Marejea* planted 10/1	First season involved with the project. Good stand of *Marejea* now seeding. Adjacent rice plot poor vigor.
Shabani Njetile	*Marejea* (total 85 x 42 m) planted 30/1, 6/2 and 10/3 and pigeon pea (45 x 15 m)	First season involved with the project. On sandy soil at top of slope. No *Striga* here but farmer interested in green manures to improve soil fertility. “People laugh at us for growing *Marejea* but next year we will plant rice and people will get our reply”.
Joseph Panja	*Marejea* (10 x 5m) planted 27/12.	First season involved with the project small plot planted under a tree – to see how crop grows and for seed. No pigeon pea as farmer says seed came late - not so according to VEO.
Juma Mtawa	*Marejea* (8x20m) planted 9/1.	First season involved with the project. Sandy upland field. Growing *Marejea* to reduce *Striga* and to improve soil fertility.
Primary school	*Marejea* planted 25/2	Field in school compound. No rice plot planted as a comparison in the coming season and no pigeon pea planted.

Table 3c Itope village – Kyela District

Farmer	**Plots planted**	**Comments**
Samson Mwakanyamale	Rice after *Marejea* or pigeon pea planted 28/12. Two other plots of *Marejea*. Rock Phos. on rice 20 x 40m	Second year with project. Rice vigor and panicle size greatest in plot after *Marejea*>after pigeon pea>after rice. Continuous rice weeded twice but after *Marejea* weeded only once. *Marejea* plots excellent – 10 x 50 m and 10 x 80 m. Rice stand on rock phosphate treated area poor as farmer had used herbicide (ametryn) with out knowing this is not selective.
Asajenie Mwakitubwa	Rice after *Marejea*; *Marejea* and pigeon pea	Third year in project. Rice after *Marejea* stunted in places and some *Striga*. Continuous rice heavily infested and very yellow. Plots suffering from drought. Farmer thinks rotation is worthwhile and will continue. Good pigeon pea here.
Andengenie Andendekisye Mwantwanga	*Marejea* (20 x 40 m)	First year with project. Steep well drained badly eroded slope. *Marejea* now flowering and vigorous. Was not weeded and is clean. Rice very stunted here, farmer emphasised that *Striga* is his major problem. Has tried to use fertiliser in past but proved too expensive and not that effective (low organic matter here?). Will harvest seed to use on other portions of field next season.
Erasto Kyando	*Marejea* and pigeon pea.	First year with project. *Marejea* and pigeon pea planted 24/12. Abandoned some of his rice due to *Striga*. Only received a small amount of *Marejea* so is now multiplying seed for next season.
Tide Kamwela	Rice after *Marejea*; new *Marejea* (0.25 acre) planted 26/2.	Second season in project. After *Marejea* rice is tall and green. Continuous rice stunted with many *Striga* plants.
Jim Andongolile Mwakibinga	Rice after *Marejea*; *Marejea*	Second season in project. Rice after *Marejea* (not incorporated) approx. 25% taller than continuous rice and expected to produce better yield. Also has sim sim following *Marejea*. Will now switch to rice *Marejea* rotation.
Amulike Mbukwa	Rice, pigeon pea and *Marejea* planted 30/2	First year with project. Excellent crop stands. *Marejea* is for seed as this is a new farmer in group.
Edward Mwang'onda	Rice after *Marejea* Rice with rock phosphate	Second season in project. Rice after *Marejea* excellent an dmore vigorous than continuous rice. Rice growth a little better where rock phosphate has been applied.

Table 3d: Kilasilo village, Kyela District

Farmer	**Plots planted**	**Comments**
Aasegelisye Mwasebe	Rice after pigeon pea, *Marejea* and rice, all with and without rock phosphate.	Pigeon pea had not performed well here in 2003 so following rice crop not as good as that after *Marejea* which is clearly more vigorous with bigger panicles than plants on continuous rice plot. No clear effect of rock phosphate. Farmer concluded that best rice, produced at lowest cost (less weeding) is on that following *Marejea*.
Chairman Asegelisye Mwaseba	Rice after *Marejea* and new plot of *Marejea* (2 acres)	Area of very poor soils on flood plain with continuous rice stunted and *Striga* infested. After *Marejea* (not incorporated as kept for seed) rice is taller and greener. Weeding was done quickly in rice after *Marejea*, while in continuous rice weeds were very dense and labourers would not weed.
Tusajigwe Isumo	Pigeon pea, *Marejea* and continuous rice	First season as member of group. Lady has experience (from earlier project) of using urea in rice. This improved rice yield but *Striga* remained and cost of fertiliser was high. Has already incorporated some *Marejea* (10 x 30) under ridges and I keeping rest for seed. Pigeon pea also excellent – says there is a good market for grain.
Saidia Mwakafyuju	Rice after *Marejea*, Canavalia, pigeon pea, cowpea	Second season working with the group. Best rice clearly on plot where *Marejea* was grown in 2003.
Agrey Aliko	Rice after *Marejea*, pigeon pea and rock phosphate. This season Canavalia, *Marejea* (45 x 8 m) pigeon pea.	On flood plain where there is dense infestation of *Striga* in rice. Rice growth improved after *Marejea* compared to after pigeon pea or continuous rice BUT still a lot of *Striga* and rice stunted here. *Marejea* was planted in depression last season and may be this is are where Striga seed has been concentrated over the years so infestation level is very high. Rice treated with RP more vigorous here.

Table 3d: Kilasilo village, Kyela District cont.

Farmer	**Plots planted**	**Comments**

Alfred Mwamundela	Rice after pigeon pea; rice with Rock phosphate after pigeon pea; new plots pigeon pea and *Marejea*.	After pigeon pea rice is tall and vigorous compared to continuous rice. Growth of a second rice crop after a pigeon pea crop is poor. Current pigeon pea crop looks good. Little effect of rock phosphate here. Very light so blown by wind when spreading.
Kibatika Mwandenuka	Rice after *Marejea* or pigeon pea. *Marejea* (48 x 48 m)	Eroded stony site. Rice vigorous after *Marejea* or pigeon pea. Farmer also multiplying one of rice lines obtained from WARDA.
Jaili Mwakatage	Rice after *Marejea* and pigeon pea. Also Rock phosphate plots. Two other large areas of *Marejea* for improving fertility.	One or original group members. Rice after *Marejea* excellent – farmer already had taken three cuts of panicles. Rice after pigeon pea also better than continuous rice. Effect of rock phosphate not clear. Farmer has adopted use of *Marejea* on many parts of his farm including planting cassava and sweet potato. He does not think it really matters if *Marejea* is incorporated or not, still is beneficial.
Erasto Mwaipopo	Rice after *Marejea* or pigeon pea with new *Marejea* (80 x 20 m) and pigeon pea plots in 04. Also tested rock phosphate.	Second year. Field on flood plain. Rice after *Marejea* much improved compared to continuous rice. Farmer adopting. Pigeon pea not growing as well here as else where – poorer soil and water lodging. Rice on rock phosphate plot poor vigor!

II: Performance of Rice/Maize following *Crotalaria*/pigeon pea Kyela-Matombo 2003/2004 season

Material and Methods:
In the previous season farmers planted three plots for demonstration, which included plots of *Crotalaria*, Pigeon pea and rice or maize (for Matombo) plots. During this current season all the three plots were cultivated and planted with either rice or maize. The continuous cereal plot was used as a control. Data was collected from an area of 5m x 5m from each plot and the observation made included frequency of weeding, *Striga* counts at 12 weeks after planting and rice/maize grain yield. In Kyela all plots were planted with rice, while in Matombo more farmers planted maize and few rice on the rotation plots. Rice is generally grown at higher altitude sites that were less convenient for the demonstrations.

Results and Discussion:
The results varied from one farmer to the other and from village to village as well as from location to location. This was due to management, soil variation, intensity of *Striga* infestation in the field and climatic differences. Generally the rotation of green manure increased the yield of cereals significantly. The addition of ground phosphorous rock did not improve the yield of rice, indeed it was observed to have a negative effect. The possible reason for poor rice performance after application of phosphorous rock is that immediately after it had been applied there was no moisture in the soil for more than a week, hence it affected the vegetative growth of the crop. The plots will be observed again during this season to monitor its residual effect.

Kyela:
At all locations in Kyela rice following *marejea* produced the highest yield. The poorest yield was obtained from continuous rice. The yield increase at Kilasilo due to *marejea* was 76% and due to pigeon pea was 14% (Table 1). At Itope village the yield increase following *marejea*, especially on plots with added phosphate rock was 500% but without phosphate yield increase was only 1.7% (Table 2). Previous soil analysis indicated soils to be very low in phosphorous. The yield ranged from 0 to 4t/ha. At Sinyanga village the yield following *marejea* was 0.9t/ha while on plots of continuous rice was 0.5t/ha - a yield increase was 80% (Table 4). The yield ranged from 0.4 to 1t/ha.

Matombo:
In Kiswira, the plots planted togreen manure or maize in 2003 were all planted with maize variety TMV-1 in 2004.. Highest maize yield was recorded after pigeon pea although this was not statistically higher than the yield after m*arejea* . The lowest maize yield was observed from plots under continuous maize. The maize yield increase due to pigeon pea was 160%, while that due to *Marejea* was 140% as compared to the control. The maize yield ranged from 0 to 2.4t/ha.(Table 5).

At Kibangile village some farmers planted rice following green manure while others planted maize. Highest maize yield was observed following *marejea* treatments and least was harvested from continuous maize plots. Compared to the control, the yield increase due to *marejea* was 120% and due to pigeon pea was 80 % (Table 6). For those plots which were grown with rice, the highest rice yield was obtained from rice following *marejea* followed by rice after pigeon pea. Yield increase due to *marejea* was 126% while due to pigeon pea was 87% (Table 7)

Table 1: Yield performance of rice grown in rotation with green manure Kilasilo Village – Kyela 2004:

Treatment		**Rice yield with phosphate rock**	**Rice yield (t/ha) without phosphate rock**
Marejea - Rice		1.4	1.7
Pigeon pea - rice		1.1	1.1
Rice - Rice		0.8	1.0
G. Mean		**1.09**	**1.28**
S.E.			
Range		0.0 – 3.2	1.28
Yield increase (%)	***Marejea***	**75**	**70**
in plots of	**Pigeon pea**	**38**	**10**

Table 2: Yield performance of rice grown in rotation with green manure Itope Village – Kyela district 2004

Treatment	**with phosphate rock**	**without phosphate rock**	
	Rice yield (t/ha)	**Striga count 12 WAP/25m2**	**Rice yield (t/ha)**
Marejea - Rice	1.2	5	1.78
Rice - Rice	0.2	21	1.75
G. Mean	**0.68**	**12.8**	**1.76**
S.E.	**0.49**	**8.6**	**0.55**
Range	0 – 4	0 – 70	0 – 4
Yield increase (%) in *Marejea* plot	**500**		**1.7**

Table 3: Yield performance of rice grown in rotation with green manure Konjula –Kyela 2004:

Treatment	**Striga count 12WAP/25m2**	**Rice yield (t/ha)**
Marejea – Rice	2.5	2.3
Rice – Rice	6.0	1.3
G. mean	**4.25**	**1.78**
S.E	**0.98**	**0.74**
Range	2-10	0.2-6.0
Yield increase (%) in *Marejea* plot		76.9

Table 4: Yield performance of rice grown in rotation with green manure Sinyanga –Kyela 2004:

Treatment	**Striga count 12WAP**	**Rice yield (t/ha)**
Marejea – Rice	0	0.9
Rice – Rice	2	0.5
G. mean	**0.8**	**0.68**
S.E	**0.54**	**0.09**
Range	0 - 3	0.4 – 1.0
Yield increase (%) in *Marejea* plot		**80**

Table 5: Yield performance of rice grown in rotation with green manure Kiswira Village –Matombo 2004:

Treatments		**Maize yield (t/ha)**
Marejea – maize		1.2A
Pigeon pea - maize		1.3A
Maize – maize		0.5B
G. Mean		**0.98**
S.E.		**0.21**
Range		0 – 2.4
Yield increase (%) in plots	***Marejea***	**140**
of	**Pigeon pea**	**160**

Table 6: Yield performance of rice grown in rotation with green manure Kibangile – Matombo 2004:

Treatments		**Maize yield (t/ha)**
Marejea - maize		2.2
Pigeon pea - maize		1.8
Maize – maize		1.0
G. Mean		**1.67**
S.E.		**0.35**
Range		0.4 – 2.8
Yield increase (%) in plots	***Marejea***	**120**
of	**Pigeon pea**	**80**

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Table 7: Yield performance of rice grown in rotation with green manure Kibangile 2 – Matombo 2004

Treatments		**Maize yield (t/ha)**
Marejea – rice		6.8
Pigeon pea - Rice		5.6
Rice – rice		3.0
G. Mean		**5.13**
S.E.		**1.46**
Range		2.4 – 10
Yield increase (%) in plots of	***Marejea***	**126**
	Pigeon pea	**87**

III. Field day at Kilasilo - Kyela June 2004

Introduction

Research and extension staff have been working with Kilasilo farmers aiming at enhancing rice productivity in *Striga* infested soils that are also highly depleted of fertility. Kilasilo farmers have been using *Crotalaria* and pigeon pea to improve soil fertility and control *Striga* infestation. In the course of time Kilasilo farmers have appreciated the technology and gained a good experience in using green manure to improve soil fertility and control *Striga*. In the process of scaling up, farmers from three villages Ibanda, Ushirika and Ngana were invited and facilitated to visit Kilasilo village to learn the technology from their fellow farmers. The visit was done on the 14th June 2004

Objective

The main objective of the field day was to expose farmers from Ibanda, Ushirika and Ngana to the activities done by fellow farmers in Kilasilo and creating a favorable environment for farmers to exchange knowledge and experiences.

Opening

The Chairman of the village government welcomed all participants and guests. He apologized for delay of some of the host farmers. Then the research group leader introduced all participants to the host farmers and he gave the program of activities.

The retiring District Agricultural officer Mr. Mwambungu, took the advantage of the gathering to introduce a new officer and called upon farmers and other stakeholders to give him co-operation after resuming the office.

Field visit

The visited plots belong to the following farmers, which belonged to the following farmers:

Erasto Mwaipopo

In his field farmers were shown *Crotalaria* and pigeon pea in separate plots. In addition, they were shown plots that had rice after *Crotalaria* and rice after pigeon pea. Visiting farmers were informed that *Striga* was reduced after *Crotalaria* and after pigeon pea at the same time the yield increased. Infestation of other weeds is also reduced, in plots where *Crotalaria* was grown one light weeding was done while in other plots two weeding were necessary. Assessment of yield was done by farmer himself in plots of 5x5 m^2. Where there was *Crotalaria* 5.5kg of rice was harvested and 5.0 kg where there was pigeon pea. A plot which had rice for the consecutive season produced a yield of 1.0 kg of rice. The visiting farmers asked the following questions

Q. How do you use *Crotalaria?*

A. *Crotalaria* at flowering stage is cut and ploughed under or left as mulch

Q. What is the name of *Striga* in Ndali language
A. Kalilo (Fire) or Kaloshi (Witch)

Q. Why using small area for measuring yield?
A. The purpose is to have an equal area for comparison

Q. Is the pigeon pea used here local or improved?
A. Pigeon pea grown is improved, it resists wilting disease. The name of the variety is Mali.

Q. Is pigeon pea edible?
A. Yes it is edible.

The visiting farmers were shown a plot planted with *Canavalia spp,* another legume crop and the following questions were asked:

Q. Is *Canavalia spp* edible
A. Yes, but need special treatment before eating

Q. Are the *Canavalia* plants burnt because they look woody
A. No they decompose fast

Q. Why is rice planted in rows?
A. Planting in rows has the advantages of saving seed, weeding becomes easier than broadcasting and improves tillering of rice plants.

Q. What is the spacing for rice and how many seed are sown per hill?
A. The spacing is 20 – 25 x 20-25 cm^2, where 3-4 seeds are sown per hill.

Q. Where can we get *Crotalaria* seed?
A. Seed are sold here in the village.

Q. Can we use local pigeon pea variety to improve soil fertility?
A. Yes provided the soil is completely covered by the canopy. The recommended spacing for improved variety is $1x1m^2$

Kibatika Mwandenuka
There, visiting farmers saw about 1.5 acre of *Crotalaria* and a small plot of pigeon pea. In addition, the visitors were shown a harvested area that was fertilized using *Crotalaria*.

Q. Do you weed *Crotalaria* plot?
A. No when *Crotalaria* is dense enough to cover the soil surface no weeding is needed.

Q. How do you cut *Crotalaria* in the field?
A. A common cutgrass is used for cutting.

Aggrey Aliko
The visitors were shown *Crotalaria*, pigeon pea, *Canavalia spp* and a harvested area that was fertilized using *Crotalaria* and pigeon pea.

Tusajigwe Isumo
There was *Crotalaria* already ploughed under and pigeon pea at flowering stage, she wanted to compare the potential of plough under and mulch. Furrows have been used in ploughing under.

Q. Do you have another plot where you had *Crotalaria*?
A. No because I was using Urea.

Wrap up session
After the field tour, visiting farmers, host farmers, research team and all other participants gather to evaluate the tour. The session started by the host farmers to give the history of their research group. The farmer research group chairman also explained how they reached a point of fertilizing their fields using *Crotalaria*, pigeon pea and *Canavalia spp*. He explained after the long time research they have realized the advantage of using green manure in enhancing production of rice by reducing *Striga* and fertilizing the soil.

The chairman informed the visiting farmers that the farmer research group in Kilasilo has been registered as a credit society. This ensures sustainability of the group apart from research activity. The major challenge of the Credit society is to give loan to members so that they can have a pair of oxen and an ox-plough. In this session the following questions were asked:

Q. Why there is no group plot, all visited plots were individuals ones?
A. There are plans to have a collective rice field, for the time being collective activities are brick making and maize growing for the purpose of improving the capital of the Credit society.

Q. Why only two of the visited plots provided data?
A. Data for all plots are available.

Q. How can we obtain seed for *Crotalaria* and pigeon pea?
A. There is a plan of starting a shop in the village for selling seed, but for the time being contact a group chairman.

Q. Are there diseases and insects attacking *Crotalaria* and pigeon pea?
A. Pigeon pea are attacked by insects (flower eaters) but there no insect attacking *Crotalaria.*

Q. There was no explanation about *Ramphicarpa* research.
A. This season there was no *Ramphicarpa* in the field, but that weed can be controlled by application of Herbicides Ronstsr and 2, 4-D

Q. Why were group members were given loan for buying inorganic fertilizer?
A. The loan was requested by those who do not have *Crotalaria* in their field.

Q. If the project started seven years ago why were we not included in the project activities before?
A. The time for scaling up was not yet until to-date

Q. Since the group had *Crotalaria* for seven years then they must give us seed for multiplication!
A. Seed are available for anyone who requires it.

Q. What is the right time for planting *Crotalaria?*
A. First rains of the season is the best time for planting *Crotalaria.*

Q. Are people outside Kilasilo village allowed joining the credit society?
A. All people in Kyela District are allowed

Q. Is there an entrance fee?
A. Yes the entrance fee is 3,000 Tshs and 10,000 Tshs for one share, but before paying you have to write an application letter to the executive committee for scrutiny. The committee has the mandate to accept or reject an application for membership.

Q. Is it necessary to have a small plot as a first year participant?
A. No you can start with a large plot depending on your ability, small plots are meant for research and learning purposes.

The Project Coordinator wound up the discussion by giving the history of *Striga* research, the importance of using green manure and the importance of forming farmer research groups. He promised to provide five farmers from each new village with a kilogram of *Crotalaria* seed to be planted next season.

Closing up
The village chairman of the host village closed the tour by calling upon the visiting farmers to put into practice what they learnt from that tour. He assured them that the technology works and it is the cheapest for the resource poor farmers who are the majority of the village dwellers. He finished by wishing all participants nice trips to their destinations.

List of participants

Dr A. Mbwaga	ARI-Ilonga
J. Kayeke	ARI-Uyole
A. Mwambungu	District Agricultural Office
A. Mwaipopo	District Agricultural Office
M. Mwampaja	District Agricultural Office
H. Mwangosi	District Agricultural Office
W. Mwaipaja	District Agricultural Office
K. L. Mwabulambo	District Agricultural Office
A. Z. Katolika	District Agricultural Office
Fenta Mwanjala	Ibanda village
Gabriel Mshiko	Ibanda village
Kisa Kajinga	Ibanda village
George Kafuko	Ibanda village
Biniface Kajuni	Ibanda village
Abel Mwakibinga	Extension officer Ibanda village
Miswelu Kanyika	Ngana village
Emanuel Mbalwa	Ngana village
Zawadi Shimwela	Ngana village
Tungapesya Mlungu	Ngana village
Watson Kalago	Ushirika village
Ketson Mbwaga	Ushirika village
Winfred Shimwela	Ushirika village
Zabron Kyamba	Ushirika village
Lydia Kalinga	Ushirika village
Ernest Musa Nyato	Extension Officer Ush. Village
Oscar Mbonge	Kilasilo village
Asegelise Mwaseba	Kilasilo village
Aggrey Aliko	Kilasilo village
Sankey Kandonga	Kilasilo village
Tusajigwe Isumo	Kilasilo village
Bernard Mwakalinga	Kilasilo village
Erasto Mwaipopo	Kilasilo village
Mwasamwene	Kilasilo village
Jail Mwakatage	Kilasilo village
Sholla	Kilasilo village

IV: Field Days in Matombo June 2004

Introduction

On May 19 and 20th 2004, successful field days were held at Kiswira and Kibangile villages, in Matombo division, at which farmers were informed briefly on the biology, life cycle and control options for *Striga*. They had an opportunity to visit demonstration plots for *Striga* management executed by farmers involved in the project from both villages. Researches from ARI-Ilonga in collaboration with extension staff presented the biology and *Striga* control options and this was followed by field tour. Each day was concluded by discussions on how new farmers can become involved in project activities. They requested their fellow farmers to get them supplied with *Crotalaria* seed to practice in their individual plots backed up with knowledge obtained from this gathering.

Objectives of the field visit

1. To provide a forum for participating farmers in the project to present their awareness and experiences on management of soil fertility and *Striga* control.
2. To enable new farmers to compare experience and exchange information on the *Striga* management options.
3. To make a way forward on soil management and *Striga* control options.

Keynote address by the Matombo division executive officer.

The division executive officer (Ms Grace Timothy) thanked the organizers for inviting her to the field visit and acknowledged the valuable collaboration between NRI, ARI Ilonga, extension and all collaborating institutions leading to farmer participatory research on the improvement and *Striga* control in both two villages. She emphasized the need to increase knowledge of agriculture to primary school pupils since many of them will become the farmers of tomorrow farming community. The officer encourage the participants to put forward all pertinent issues related to the field tour objectives as it is through approaches such these that improved crop yields and household incomes of Tanzanian people can be realized.

Kiswira village

A total of 36 farmers attended with division, ward and village officers. DALDO, who was represented by Mr Mkumbo called upon all participants to utilize the opportunity of attending the tour to learn what is important to be applied in their respective farms and farming community at large. He then declared the tour opened for viewing.

Field Sites tour

1. George Mkami.

The field of farmer research group member Mr George Mkami was first to be visited. The field had three plots for maize planted after *Crotalaria*, pigeon pea and maize. Visiting farmers appreciated the good stand of maize in the plots previously grown with *Crotalaria* and pigeon pea. Farmers asked questions.

Q: What crop was on the field before pigeon pea and *Crotalaria*?

A: Before green manure cassava was grown for two consecutive years because the area was a hot spot for *Striga* infestation.

Q: What is the trend of *Striga* after planting green manures?
A: The infestation has diminished though is the first season of crop after green manure.
Q: What crop will be planted next season?
A: Crotalaria / pigeon pea then maize.
Q: What is best time to plow under the green manure plants?
A: At flowering stage.

2. Otto Nzeru
He had planted maize in three plots; previously sown with *Crotalaria*, pigeon pea and maize respectively. The crop was good though rain this season was not adequate. Also there were good plots for green manure.

Q: What are your future plans?
A: I will plant maize in all plots with green manure and where is maize is planted now I will establish green manure.
Q: What type of maize grown?
A: Is a Staha variety.

3. Albertina Thomas
She had maize in three plots; previously plots were established with *Crotalaria*, pigeon pea and maize respectively. The crop was good though rains this season was not adequate. Also there were good plots for green manure.

Q: What is the extent of *Striga* problem in your field?
A: Was very high before I started using green manure.
Q: What is you measure to know if green manure really fertilizes land/
A: Comparing the yield from plot established with *Crotalaria* previously to that continuously planted with maize.

4: David Mdachi
He had *Crotalaria* and pigeon pea in his plot, next season all plots will be planted to maize and a comparison will be done of the performance of maize with and without rotation with a green manure.

Q: When did you plant Crotalaria and pigeon pea?
A: Planting was done in February.
Q: What is the recommended method you prefer most?
A: Both planting in rows and broadcasting.

Wrap up session
All farmers sat together and evaluated their tour. The group chairman explained a short history of the research group, which started with ten farmers but today there are 23 active farmers who are participating in the use of green mature to control *Striga* in upland rice. The village chairman urged to all participants to make sure that the technology reaches as many farmers as possible and is practiced.

Kibangile village
The field day, held on 20th May 2004, was attended by 80 farmers and the division executive leaders. DALDO representative opened the field tour by calling up all the participants to honor the opportunity of attending the tour. She urged them to observe clearly and put in practice the knowledge gained on their own fields.

Tour to the demonstration plots
In this village they managed to visit only three fields, because the same farmers were to attend their village general meeting during the afternoon. This enabled us to get a good number of participants.

1. Anjelika Aloyce

There were good plots for rice planted after green manure. Crop establishment was good but the crops needed rain because they were planted late. The fields were heavily infested with *Striga asiatica* and *S. forbesii*. The plot for pigeon pea was inter-cropped with maize.

Q: What kind of pigeon pea you have planted last season?
A: It is “Mali” variety.
Q: What kind of crop you have planed to plant in this area next season?
A: All plots will be established with green manure
Comments: Following the high *Striga* infestation in the rest of research field, farmer was advised to look for more *Crotalaria* seed to fertilize the rest of the fields.

2. Hadija Salum

Had good plots established with rice following *Crotalaria.*

Q: What is the purpose of conducting such demonstrations?
A: I imitated my sister who practiced the rotation in her field and a got very good crop last season.
Q: What is your future plans regarding this demonstration?
A: To continue rotation of rice and green manure.
Q: Where will you get green manure seed for next season?
A: I have a reserved plot for seed production.
Q: How frequently other farmers asking about the technology have visited you?
A: Very frequently bearing in mind the field is near the road

3. Kibangile Primary School

The school had very good maize plots established following green manure. Also there were good plots of green manure that will be planted with maize next season.

Q: Which classes are involved with lessons regarding these demonstrations?
A: Standard IV – VII. Much emphasis is placed to class VII because very soon they will become farmers after completion of their std seven class.
Q: What is the spacing for pigeon pea?
A: 120m x 30m
Comments: They were urged to increase the plot size of their demonstrations.

Wrap up session

After the field visit, all participants gathered together at school premises. Pupils entertained the visitors with poems, drama and songs. All these were about sensitization on *Striga* (biology, effect on crop, types and control measures). Farmers appreciated what they saw and they promised to use what they had learnt in this field tour. They also promised to pass on the knowledge they have gained to other farmers in the village.

On-farm verification and promotion of green manure for enhancing upland rice production on Striga infested fields

List of Participants Participated for each Village

Kiswira village

1.	Grace S. Timoth	Division executive officer
2.	Patrick Francis	Village chairman
3.	George S. Mkami	Group chairman
4.	Ema Mwenda	Farmer
5.	Paulina Livinusi	Farmer
6.	Veronika Dominic	Farmer
7.	Yusta Livinusi	Farmer
8.	Yustina Joseph	Farmer
9.	Annamary Paul	Farmer
10.	Cryspian Henry	Farmer
11.	Vincenti Urbani	Farmer
12.	Rose Patrick	Farmer
13.	Julieth Christopher	Farmer
14.	Maiko Romani	Farmer
15.	Faustine Andrea	Farmer
16.	Antonia Mlalwe	Farmer
17.	Rose Romani	Farmer
18.	Theresia G.N	Farmer
19.	Theresia Daudi	Farmer
20.	Barthomeo Lukoa	Farmer
21.	Cornel Massawe Researcher	
22.	Heriel Kisumo VEO	
23.	Mrs Mkumbo DALDO Representative	

Kibangile village

1.	Grace S. Timoth	Division executive office
2.	V. Nyemele	Cluster-chairman
3.	Hoseni Lugazo	Elimu-Representative
4.	Ramadhani Kombo	VEO
5.	Heriel Kisumo	VEO
6.	Mrs Mkumbo	DALDO Representative
7.	Cornel Massawe	Researcher
8.	Amos L. Fabian	Teacher
9.	Yahaya Selemani	Chairman
10.	Mango Makoko	Teacher
11.	Filbert Romani	Chairman
12.	Salehe Ahamadi	Sub-village chairman
13.	Beatus E. Kunambi	Researcher farmer
14.	E. G. Mpangala	Farmer
15.	Abel Mbunda	Farmer
16.	Abdul Ally	Researcher farmer

17. Nassoro Shomary	Farmer
18. Kwanyu Hamisi	Researcher farmer
19. Veronica William	Researcher farmer
20. Stephania John	Researcher farmer
21. Ramadhani Bakari	Farmer
22. Fadhili Hosseni	Farmer
23. Salima Juma	Farmer
24. Mama Ramadhani	Farmer
25. Stahimili Ally	Farmer
26. Mwajabu Ramadhani	Farmer
27. Amina Ramadhani	Farmer
28. Pili Mohamedi	Farmer
29. Hadija Salum	Farmer
30. Sabina Thomasi	Farmer
31. **Noel Amlo**	Farmer
32. Kossi Nassoro	Farmer
33. Shukuru Mohamed	Farmer
34. Thomasi John	Farmer
35. Juma Amani	Farmer
36. Abdu Selemani	Farmer
37. Josephina Amosi	Farmer
38. Halima Ramadhani	Farmer
39. Halima Saidi	Farmer
40. Stahimili Ramadhani	Farmer
41. Salome Tisiani	Farmer
42. Veneranda Francis	Farmer
43. Asha Semani	Farmer
44. Amina Ramadhani	Farmer
45. Tuhuma Salumu	Farmer
46. Salima Juma	Farmer
47. Rashidi Hoseni	Farmer
48. Ramadhani Saidi	Farmer
49. Maua Ramadhani	Farmer
50. Pilli Fuku	Researcher farmer
51. Salima Abdalah	Farmer
52. Shida Ramadhani	Farmer
53. Luhingilo Kisomo	Researcher farmer
54. Annastazia Molisa	Farmer
55. Zainabu Abdul	Farmer
56. Nuru Athumani	Farmer
57. Anjelika Aloyce	Researcher farmer
58. Frida E. Mshitu	Farmer
59. Bertha Kaiza	Farmer
60. Christina Donnath	Farmer
61. Matrida Saidi	Farmer
62. Ashura Hoseni	Farmer

63. Morisia Zakaria	Farmer
64. Anthoni Pius	Farmer
65. Hadija Issa	Farmer
66. Asha Hosseni	Farmer
67. Annastazia Jonas	Farmer
68. Grace Waziri	Farmer
69. Stela John	Farmer
70. Asha Salehe	Farmer
71. Veronica Thobias	Farmer
72. Atiba Ally	Farmer
73. Amina Kassimu	Farmer
74. Anna Damian	Farmer
75. Makonde Juma	Farmer
76. Theresia John	Farmer
77. Mwajabu Ramadhani	Farmer
78. Tatu Ally	Farmer
79. Mwanaisha Msomeleni	Farmer
80. Anna Saidi	Farmer

V. FARMERS EXCHANGE VISIT TO MATOMBO

Background information:

The farmers exchange visit approach is used for the purpose to educating farmers by seeing, sharing information and experiences. The visit allows farmers with little experience to learn from those with long experience of solving a shared problem. In addition, the experienced farmers can visit and motivate their fellows. The exchange visits therefore enable farmers:

- To have an informal interaction where ideas, problems and success can be discussed;
- To allow farmers to gain confidence on what they are practicing in their fields;
- To encourage farmer creativity in solving their agricultural related problems.

Kyela Farmers visit Matombo farmer research groups

Kilasilo and Itope villages in Kyela District have been undertaking research to develop a low cost approach to soil fertility management and *Striga* for four years. Of the technologies tested, farmers decided to practice the use of *Crotalaria* and pigeon pea fallow because these are easy to manage, cheaper and environmentally acceptable. On 21st May 2003, 10 farmers from Matombo - Morogoro rural district visited Kyela farmers to learn on the use of *Crotalaria* and pigeon pea to the control of *Striga* in their maize and rice fields. Five farmers from each of Kibangile and Kiswira village took part in this trip. On 26th May 2004, 10 farmers made a follow up exchange visit from Kyela district to Matombo. This was meant to see how the Morogoro farmers were doing after they had learnt the technology from Kyela. Five farmers each from Kilasilo and Itope villages accompanied by two-village extension Officers visited Kiswira and Kibangile villages in Morogoro rural district.

Objectives of the exchange visit

- To learn how fellow farmers have taken up the legume-cereal rotation;
- Exchange ideas on the improvement of the rice production

Activities

On the morning of 27th May 2004, Kyela farmers paid a courtesy call to District Agriculture Office in Morogoro. The District Extension Officer welcomed Kyela farmers to Morogoro. He thanked them for sparing all other activities to come to Morogoro to visit their fellow farmers. She requested them to value the trip and make use of it for the betterment of the agriculture production in their fields back home. She wished them a nice visit and a good stay in Morogoro. After that short welcome note the farmers traveled to Kiswira village accompanied by one official from District Agricultural Office.

Kiswira village

Farmers arrived at Kiswira village; where they were welcomed by their fellow farmers accompanied by the Ward Extension Officer, the Ward Executive officer and the village

Government leader. The Village Government leader gave a short welcome note where he apologized for the delay of the program.

Farmers visited some of the selected fields, which belonged to the following members

Constantine Antoni Lukoa
The plot is planted with *Crotalaria*, pigeon pea and maize TMV 1 variety for the first year. All plots were planted on 20th March 2004. The plot is close to the main road so that people passing by can see the field. Generally, the plots are good. The farmer confidently explained what he is doing on his demo plots and questions were asked.

Q: Were you asked by other villagers about your demo plots?
A: Yes large number of people came asked me about this demo plots.

Q: Why is the fertility of your field said to be so low as you say this was your first year to cultivate this field?
A: The field has been under continuous cultivation by other people but it is my first time to cultivate this field.

Q: The slope of your plot shows the possibility of soil erosion, what are you doing to solve the problem of soil erosion?
A: I will use contours.

* *A course on water harvesting and soil conservation will be taught later*
Q: Is there *Striga* in your plot?
A: Not up to now; there is no *Striga* on my plot

Q: Have you see any benefit of growing *Crotalaria*?
A: Since this is my first year, the benefit of growing *Crotalaria* is not yet to be seen.

Q: Where is the plot for *Crotalaria* seed?
A: Since the demand for seed is high the whole plot will be left for seed.

Albertina Thomas
There were two plots one was under maize after the Crotalaria and pigeon pea while another was under *Crotalaria* and pigeon pea for the first season. The first plot that was under maize after *Crotalaria* and pigeon pea had poor maize in the control plot. On the other hand maize after *Crotalaria* was better than maize after pigeon pea. The plot was good for showing the results of the technology and the farmers gave good information on what se has been doing since last season.

Q: Why is the size of your plot small?
A: The plots are so small because are meant for research and teaching others farmers, but next year the plots will be larger than this season.

Q: Why are there two plots of *Crotalaria*?

A: The other plot belongs to another farmer.

Suggestion:
In order to solve the problem of the slope, contours must be made across the slope. It is hard to make contours but deliberate efforts must be employed to solve the problem of soil erosion.

Otto Mzeru
The plot had maize, *Crotalaria* and Pigeon pea in the first year. The trial was planted on 6th February 2004. The plot size was 15 x 10. He explained that *Crotalaria* and pigeon pea were planted to solve the problem of low soil fertility and *Striga* infestation. He also showed us the plot that had *Crotalaria* and pigeon pea last season. Plots that were under *Crotalaria* had healthy stalks than those under pigeon pea.

Q: Why do you repeat the experiment?
A: The idea is to get good results since last season the experiment was affected by poor weather.

Q: The plots that had *Crotalaria* last season had some *Striga*
A: The population of *Crotalaria* was very poor.

George Mkami
The demo plots were planted on 6th of February 2004, there is maize, pigeon pea and *Crotalaria* (Plot size 15x10). Last season pigeon pea and *Crotalaria* performed poorly because of bad weather, this season all the plots are doing well. In addition, there is another plot that was grown a cover crop (*Pueraria* spp) locally known as Kiraka from the name Clerk an agricultural officer in the area many years ago, which farmers decided as a comparison to *Crotalaria*. They observed that this plant has a very slow germination rate. Seeds of this legume were in January but germination was observed in April.

Q: Why do you have a plot for Kiraka?
A: I am investigating its ability to fertilize the soil and suppress weeds especially *Striga* in the field.

Q: *Crotalaria* has reached a stage to be plowed under, when are you going to plow it under?
A: I left it for teaching purposes otherwise I would have plowed it under.

Q: Did your neighbors show interests on the technology
A: Yes a lot of them, some have collected *Crotalaria* seed although they are not in our research group.

Q: How did you know the spacing of maize?
A: It is normally written on the bag.

Q: What is the spacing for pigeon pea?

A: 1 x 1 m^2

Q: What are you going to do next season?
A: All plots will be under maize in order to compare the performance of the crop

Suggestions:
Cut down the palm trees in your fields because they dry up the soil and bring shade.
Don’t delay planting operation to ensure that the fertility enhanced is utilized immediately to avoid loss due to slope of your plot.

Germana Peter
The plot was under maize, pigeon pea and *Crotalaria*; all performing well with the demo plot close to the foot path so that people passing by can see and learn.

Q: What variety of pigeon pea have you planted?
A: Variety Mali.

Q: How will you teach other farmers?
A: Some come to my house some are met on the way.

Suggestion:
It is important to have a poster that will be informative enough to assist other farmers to learn what you are doing

Lydia John
Her plot had *Crotalaria*, pigeon pea and maize all planted on the 6th February. All the plots are doing well.

Q: Why did you plant *Crotalaria* and pigeon pea
A: These were planted to fertilize my field and control *Striga*

Q: Why all plots were planted on 6th February
A: That was the advice from the Extension officer.

Then they showed the visiting farmers a plot of Mwangulu rice, seed of which was obtained from Kyela. The plot was first attacked by the army worms, it has now recovered and growing well

Henry Sirili

This is the first year. Pigeon pea and *Crotalaria* were planted on 4th March, maize was planted on 10th March 2004.

Q: Why planting *Crotalaria* and pigeon pea
A: To improve soil fertility and control *Striga.*

Q: What are you going to do next season
A: All plots will be planted maize to compare the performance with plots followed maize after maize.

Q: How will you compare the yield?
A: By weighing the yield obtained.

Q: What are your future plans?
A: To extend the technology to a large area.

Q: Do you have a plot with *Striga*?
A: Yes that is where the extension of the technology will be done.

Paul Matei Somvi
He has *Crotalaria*, pigeon pea and maize all were planted on 26th March 2004

Q: Why did you participate in this research group?
A: To manage *Striga* though soil fertilization

Q: Why didn't you use other sources of fertilizers like animal manure
A: *Crotalaria* and pigeon pea are the cheapest source of fertilizer

Q: What are you going to do next?
A: Test by growing maize on all plots.

Daudi Mdachi
He has *Crotalaria*, pigeon pea and maize all were planted on 10th of February. The plot of pigeon pea was inter-cropped with maize. The plot of maize was already harvested.

Q: Why did you practiced inter cropping?
A: To make use of the open spaces between pigeon pea.

Q: Where did you get the idea?
A: I was advised by the Extension officer.

Q: How was the yield of maize?
A: Very poor because of poor soil fertility and *Striga* infestation.

Suggestion:
He was advised to increase the size of the *Crotalaria* plot. In addition, the position of the plot being close to the church was an advantage for technology dissemination. Therefore, he was advised to make use of it.

Wrap up
The host farmers gave the history of their research group (appendix 1)

The visiting farmers congratulated their fellows for job well done. They appreciated what was taught in Kyela is now in practice. They also appreciated the way the Kiswira farmers were conversant and confident on whatever they did in their plots. Kiswira farmers were advised to assist other farmers in case of problems so that the development will be for the whole group up to the village level. In addition, Kiswira farmers were challenged to improve the size of the plots in order to move to another stage of adoption.

Since the research group is expected to cater for other social activity in the village then the establishment of the Credit society was highly praised as a good start towards poverty alleviation.

The Ward Executive Officer apologized for having a long programme. On the other hand she commended the job done and suggested the extension of the technology to other villages, because in the area about 33 villages are infested with *Striga*

Visiting farmers and their host and other guests had a meal and drinks together and also, there was exchange of gifts between the two farmer groups. The hosts showed a drama which encourage farmers to use scientific measures instead of wrong beliefs to control *Striga* in their fields

Kibangile village

On 28th May 2004 Kyela farmers visited Kibangile village. The host farmers welcomed them, after introduction farmers accompanied by the research team started the field tour. The fields are infested with both *S. asiatica* and *S. forbesii*. Maize was inter-cropped with pigeon pea but plant population was poor in addition, maize was sown later after pigeon pea had grown high.

Anjelica Aloys

This is the first year of the experiment. The trial was planted on 26th February 2004. She had plots of pigeon pea, *Crotalaria* and rice. The farmer explained what she has done on those plots.

Q: Why did you plant late?
A: There was a problem of obtaining seed

Q: What is the idea of using the technology?
A: To improve soil fertility and control *Striga*

Q: Why the *Crotalaria* is not yet plowed under?
A: The intention is to obtain seed.

Filbert Roman

He had two plots, one was on the second season while the other was on the first season. That of second season is all under Mwangulu rice, the area that followed *Crotalaria* was good followed by the plot which had been previously sown to pigeon pea. The plot under rice after rice was poor. The treatments were obvious. This season there is *Crotalaria*, pigeon pea and rice and these were planted on 16th March 2004. The plot size is 7 x $41m^2$. The plots are good, and situated along the footpath. On each plot there was a poster showing the treatment, date of planting. This information assists whoever passing by to read and understand what is being done on the plots. The posters were very informative hence, no questions were asked.

Abdul Ally

This is his first year; he has maize, *Crotalaria* and pigeon pea. Maize stand was poor because he replanted after the first crop dried because of drought and the spacing was poor. The plots were very small.

Q: Why are your plots so small?
A: Admitted the mistake in the first year of the trial

Q: Where did you get the information of the technology?
A: From the Extension officer.

Q: What variety of maize have you planted in the trial?
A: Local variety

Josephina Amos
The trial was planted on 3rd March 2004 it has pigeon pea, *Crotalaria* and rice. The plots are large and the crop is doing well.

Q: What is the improvement in the yield?
A: The yield has improved by 50%

Halima Ramadhani

The plots were planted on 6th January 2004. The plot size was large. Farmers appreciated the performance of the trial.

4.6 Hadija Salum
The trial was planted on 9th February; it has pigeon pea, *Crotalaria* and rice. Plots are large and impressive.

Q: What is the plot size?
A: 16 X 5 m^2

Q: What is the variety of pigeon pea grown?
A: The variety Mali

Kibangile Primary Scool
The plot is managed by the Primary School where pupils of Class 5 – 7 are taking part. The trial is doing well.

Q: What is the spacing of pigeon pea?
A: $1x1m^2$ but the space is so large next time inter-cropping with maize will be done to utilize the space.

Q: Is there a plot for seed multiplication
A: Yes

Wrap up and closing session
After the field visit, pupils entertained farmers. They had prepared Choir, drama and poems, which called farmers to put together their efforts to curb the problem of low soil fertility and *Striga* to improve their cereal production and hence improve their well being as a strategy to alleviate poverty.

The group chairman from Kyela praised their fellow farmer for commendable job they have done. It shows that the knowledge obtained during their visit to Kyela is now in practice. He argued them to increase the size of their plots to enjoy the benefit of using *Crotalaria* and pigeon pea in their fields, because they have gone beyond exploration stage. Farmers from Kyela were impressed with the dissemination methods used here in Morogoro; including farmer to farmer education, primary school and the Church are used effectively. They appreciated that these social institutions are very important in information/technology dissemination.

The farmers later exchange gifts and had a meal together bid fare well to each other
The closing note emphasized on the extending the information /technology to other farmers in the village and outside the village. In addition the ties between Kyela and Matombo farmers was highly commended and called upon farmers to maintain and strengthen it beyond the scope of the project.

General Observation from researcher point of view:

- Farmers showed a good level of understanding on what they are doing in their plots, they were able to express themselves, and answer all questions well;
- The size of their experimental plots was small probably because some farmers are participating for the first time and or being in exploratory stage of the application of the technology;
- Most of the plots are within their main fields showing a good level of acceptance of the technology;
- Having informative lablels on the plots as was done by one of the farmers in Kibangile will assist dissemination of information/technology to other people in the village, especially for plots which are adjacent to the roads sides or foot paths;
- The involvement of other social institution in the village like schools and churches is of vital importance in dissemination of information or technology as observed in Kibangile and Kiswira village;
- Using other means of reaching people in the village like the drama prepared by Kiswira farmers and Kiimbangile school is a good machinery in driving the message to target population;
- Most of the plots were planted on the same date showing that the group organisation is strong and productive;
- Most of the farmers planted TMV 1 maize variety demonstrating how the opportunity of introducing the use of improved maize seed in the project has been taken.

Lessons learnt from the observations:

- The linkage between research, extension and farmers is enhanced;
- Farmers appreciated the use of the technology in improving agriculture production;
- Records are very important tool in evaluation of the progress;
- It is important to use various means in extending the information because no single method is efficient;
- Research Institutions are very important in enhancing agricultural development.

Appendix 1: The history of Tuwalole Farmer Research Group (Kiswira village)

The group started in November 2002 with 20 members including 8 women and 12 men who were provided with seed of *Crotalaria* and pigeon pea cultivar 0068. The main objective was to plant these crops to improve soil fertility and to control *Striga*.

On 30th January 2003 the group attended a workshop organised by the project, which enabled members to:

a. To understand the research activity, opportunities, potentials and threats in agriculture production;
b. To enable the group to have a common goal and set a common strategy in implementing and developing *Striga* control measures;
c. To gather baseline data that are useful in evaluation of the project.

In February 2003 the group started to conduct a *Striga* control trial whereby *Crotalaria*, pigeon pea and maize were planted in plots of 5x10m2. The research team visited all plots for evaluation. May, 2003 the five members of the group joined other members from Kibangile to visit farmer group members in Kyela District to share experience with on the use of *marejea* and pigeon pea t0 increase soil fertility and control *Striga*. They saw how *Crotalaria* and pigeon pea cut the costs of using industrial fertilizers. After the tour, the group disseminated the technology to other farmers in the village.

Other group activities
The group is registered and has formed a credit society. The group is disseminating *Striga* control technology/information through the Catholic Church present in the village by organizing seminars and plays regarding the use of *marejea* to increase soil fertility.

List of Participants

1. Dr A. Mbwaga	ARI – Ilonga
2. C. Massawe	ARI – Ilonga
3. E. Masangya	District Agric Office Morogoro
4. J. Kayeke	ARI – Uyole
5. J. D. Mika	ZILO Office – Central zone Dodoma
6. Grace Thomas	Ward executive Officer Matombo Morogoro
7. H. Kisumo	Ward Extension Officer-Matombo
8. M Mwampaja	Agric Ext. Office Kyela
9. H. Mwangosi	Agric Ext. Office Kyela
Kyela farmers	
10. Asegelisye Mwaseba	Chairman FRG Kilasilo Kyela
11. Oscar Mbonge	Government leader, FRG Kilasilo Kyela
12. Agrrey Aliko	Vice chairman FGR Kilasilo Kyela
13. Nancy Mugogo	FRG Kilasilo Kyela
14. Erasto Mwaipopo	FGR Kilasilo Kyela

15. Tusajigwe Isumo	FGR Kilasilo Kyela
16. Samson Mwakanyamale	Chairman FRG Itope Kyela
17. Tide Kamwela	FGR Itope Kyela
18. Edward Mwang'onda	FGR Itope Kyela
19. Rehema Mwalaba	FGR Itope Kyela
Kibangile - Matombo farmers	
20. Matilda Said	FRG Kibangile Kibangile Morogoro
21. Pili Mohamed	FRG Kibangile Kibangile Morogoro
22. Stephania John	FRG Kibangile Kibangile Morogoro
23. Ahmad Dulege	FRG Kibangile Kibangile Morogoro
24. Alli Shomari	FRG Kibangile Kibangile Morogoro
25. Abdu Rajabu	FRG Kibangile Kibangile Morogoro
26. Filbert Roman	Chairman FRG Kibangile Morogoro
27. Joseph Amos	FRG Kibangile Morogoro
28. Abdu Alli	FRG Kibangile Morogoro
29. Salum Ahmad	FRG Kibangile Morogoro
30. Kwayu Daulela	FRG Kibangile Morogoro
31. Hadija Salum	FRG Kibangile Morogoro
32. Abel Ngunda	FRG Kibangile Morogoro
33. Saleh Ahmad	FRG Kibangile Morogoro
34. Anjela Aloys	FRG Kibangile Morogoro
35. Halima Ramadhani	FRG Kibangile Morogoro
Kiswira – Matombo farmers	
36. George Mkami	Chairman FRG Kiswira Morogoro
37. Edward Mawango	FRG Kiswira Morogoro
38. Albertina Thomas	FRG Kiswira Morogoro
39. Magdalena John	FRG Kiswira Morogoro
40. Otto Mzeru	FRG Kiswira Morogoro
41. Siril Henry	FRG Kiswira Morogoro
42. Isdori Malini	FRG Kiswira Morogoro
43. Vicent Midongo	FRG Kiswira Morogoro
44. Paol Matei	FRG Kiswira Morogoro
45. Germana Peter	FRG Kiswira Morogoro
46. Daudi Mdachi	FRG Kiswira Morogoro
47. Michael Roman Mloka	FRG Kiswira Morogoro
48. Antonia Antony	FRG Kiswira Morogoro
49.Veronica Dominic	FRG Kiswira Morogoro
50. Emma Mwenda	FRG Kiswira Morogoro
51. Christa Revenus	FRG Kiswira Morogoro
52. Anamaria Paul	FRG Kiswira Morogoro
53. Phillipina Yakobo	FRG Kiswira Morogoro

Appendix 2a: Kilasilo research group trip report to Matombo

Introduction:
The tour started from 26th May 2004 up to 29th May 2004. It included six farmers from Kilasilo, four farmers from Itope and two Extension officers from District Agricultural Office. The names of the participants are shown on the list of participants

Objective:
The main objective of the tour was to visit *marejea* fertility improvement trials that are conducted by Matombo farmers. This was done to exchange ideas and experiences on *Striga* control trials that are conducted by both villages.

Activities:
A visit to Farmer Research group in Kiswira village
On 27th May 2004 ten research plots were visited in Kiswira village, the plots belonged to the following farmers

Konstantin Antony Lukoba
Albertina Thomas
Otto Mzellu
George Shomari Mkami – Chairman
Gemana Peter
Ldyia John
Siril Henry
Antonia Antony
Paulo Mateo Shomvi
Daudi Mdachi

We saw well established plots of *marejea*, pigeon pea and maize which were in a good stage of growth. From our observation we advised them to:

- Increase the size of their demo plots;
- Plant early on the on-set of the rain;
- Use *marejea* to improve soil fertility, control *Striga* and reduce weed infestation;
- Use contours to control soil erosion on steep slopes which is a dominant feature in the area.

What was learnt from Kiswira village:

- The process of disseminating the *Marejea* technology by using the Church in the village.
- Their plots are close to the main paths and one of the plots is close to the church so that many people to church service can see them;
- They prepared a drama which convey a message on the use of *marejea* technology to improve cereal production instead of false beliefs;
- The history of Kiswira group.

A visit to Kibangile Farmer Research group.

On 28th May 2004 we visited Kibangile farmer's research group. The plots visited were from the following farmers;

Philbert Roman Balala- Chairman
Anjelika Aloys- Vice chairman
Josephina Amos- Secretary
Abdul Ally
Halima Ramadhani
Hadija Salum
Kibangile Primary School

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Their plots were of *marejea*, pigeon pea and rice. The plots were well managed but small in size, we gave them a similar advice as we did for Kiswira farmers.

What did we learn from Kibangile research farmer group:

- Dissemination of *marejea* technology is by using primary school pupils who are the future farmers;
- The demo plots had a poster showing the date of planting, weeding and the size of the plots;
- Short history of the group.

Acknowledgement:

We would like to thank all who participated to facilitate the tour, these include:
The project leader Dr A. Mbwaga and his colleagues; District Agricultural Extension Officer (Morogoro) Mrs E. Masangya; Ward Executive officer (Matombo- Morogoro) Grace Timoth Sholle, and Mr H A Kisumo (Extension officer - Kisemu Division).

Kiswira village
Mr Patric Franasis-Village chairman
Leaders of the Catholic Church in the village
All members of the farmer research group

Kibangile village
Village chairman
Village executive officer
The headteacher of Kibangile Primary School
All teachers and pupils for their plays and drama
All members of the farmer research group

On 29th May 2004 we took off for Kyela

Prepared by
Asegelisye Mwaseba
Group Chairman, Kilasilo Kyela.

Appendix 2b: Itope research group trip report to Matombo

Introduction:
On 26th May 2004 we arrived in Morogoro, where we were met by Dr Mbwaga. The next day we paid a courtesy call at Morogoro Agricultural District office then we left for Matombo.

Activities:
We visited Kiswira village accompanied by District Agricultural officer, Ward Executive officer and ward extension officer. We visited nine plots that had *marejea*, rice and pigeon pea. The crop stand in the field was good.

On 28th May 2004 we visited plots of six farmers in Kibangile village one of the plots belong to Kibangile primary school. The plot had *marejea*, pigeon pea and maize. The crops in the field were good.

What did we learn:
- They cooperate and coordinate filed operations like planting;
- Their plots are well managed;
- They cooperate with extension officers, teachers and pupils;
- The climate is warm like that of Kyela

Prepared by

Edward Mwang'onda
Group Secretary of Itope farmer research group Kyela

Appendix 2c: District agriculture extension office trip report to Matombo

Introduction:
The tour included six farmers from Kilasilo and four farmers from Itope villages, accompanied by extension officers M. Mwampaja and H. Mwangosi. The main purpose of the trip was to go and see efforts of Matombo farmers to control *Striga* in their maize and rice fields. Last season 2003, Motombo farmers visited Kilasilo and Itope villages in Kyela District for the aim of learning to increase soil fertility and hence to control Striga.

Leaving for Matombo via Morogoro
The journey started on 25th May 2004, we arrived in Morogoro on the same day. We met Dr Mbwaga and Mr. Massawe (ARI Ilonga), who the next day together with Mr J Kayeke (ARI-Uyole) and Mrs Masangya (District Agricultural Office-Morogoro) led us to Matombo.

We arrived at Mtamba the headquarters of Matombo ward around 11:00 am. There we were met by our hosts who had made all the necessary arrangement for our stay. We started-off to our fist destination accompanied by Ward Executive officer Ms Grace Timoth and the extension officer H. Kissumo.

At Kiswira village
The village government chairman welcomed us, after introduction we went to the field. We started with the plot of Constantine A. Luka , but due to a shortage of time we visited only ten trials. The total number of participating farmers is 20, where eight are women.

What we saw in the field
- In Matombo there are two species of *Striga* (locally known as Sani) *Striga asiatica* and *Striga forbesii* while in Kilasilo and Itope there is only *S. asiatica*;
- The main crop in Kiswira is maize while in Kilasilo and Itope is rice;
- Apart from *Marejea* and Pigeon pea used to improve soil fertility there is another cover crop called Clark (*Pueraria spp*). This was found in chairman's plot;
- The rains for the season of 2003/04 were not good for the crop;
- Mwangulu rice which was given to them as a present from Kyela is performing well. At Kiswira, it was planted on Lydia's plot on behalf of the group. In addition like other farmers she had plots of maize, *Marejea* and pigeon pea;
- Inter-cropping of maize and pigeon pea was a personal initiative by Mr Mdachi;
- Improved varieties of maize Staha, TMV1 and pigeon pea Mali are used in the demonstrations;
- The size of the demos plots ranged from $5x10m^2$ to $25x25m^2$;
- The date of planting was observed by all participating farmers as directed by the extension officer and was almost the same for all farmers;
- This was the second season to conduct these demos but there is a big number of farmers who have shown interest to join the research group

Advice given

- Otto Mzellu was advised to make contours across the slope because of the steep slope of his plots;
- Participating farmers were advised to use the technology in large plots instead of the small ones, which they have now.

Wrap up session

A wrap up session was held before leaving for Mtamba. During the session:

- The History of the research group was given. The group has a savings account in the bank. The group use the church for dissemination of the information about *Striga* control using *Marejea* and pigeon pea;
- The group showed a drama which call upon farmers to improve soil fertility of their fields by using *Marejea* and pigeon pea;
- There was an exchange of gifts between visitors and host farmers' groups also there was meal and drinks organized by the host farmers;
- The Ward Executive officer appreciated the technology and pointed out that all the 33 villages in her Ward are infested with *Striga;*
- Mr Kayeke appreciated the effort of farmer who inter-cropped maize with pigeon pea, and emphasized on the use of improved varieties;
- Dr. Mbwaga emphasized on the increase on the size of the plots. They do not need to continue with small plots which they are using now. He congratulated them for forming a credit society (SACCOS);

  Other congratulations and encouragements were from Mr Mwampaja, A. Mwaseba and Mrs. T. Kamwela. The session was closed and we left for Mtamba.

At Kibangile village

The next morning we visited Kibangile village, where we were met by farmers participating in the project, and village government chairman (Mr. Yahaya Selemani). We introduced each other before going to the fields. Due to shortage of time and hilly nature of the countryside, we managed to visit six farmers demo plots and including that of the primary school.

What we saw in the field

- The problem of *Striga* is of the same magnitude as that of Kiswira;
- Their fields are infested with two species of *Striga* like Kiswira;
- The knowledge to combat *Striga* is given in different ways using primary school children, demonstration plots, choir and poems;
- Crops which are planted in their plots are either maize or rice;
- The average plot size was 15x15m$^{2;}$
- The variety of pigeon pea planted is Mali;
- Group members are increasing after appreciating activities of the group.

Advice given

They were advised to increase their plot sizes in the following season

Wrap up session

At the meeting, Kibangile primary school pupils conveyed a message of *Striga* control by choir and poems. During the session:

- The short history of the group was given by the vice chairman of the group
- On behalf of the visiting farmers, Mr Oscar Mbonge and Erasto Mwaipopo congratulated the group for the development reached and called upon them to continue with the same spirit. In addition Mr Mwangosi praised the effort of the school to convey the message of *Striga* control, while Mrs Masangya requested all participants to put into practice what they have learnt from this tour.

Then visitors were served with lunch by host farmers before leaving for Morogoro

Conclusion

Farmer exchange visits are very important and give a challenge to participating parties. Apart from meeting others, there are chances of exchanging ideas, experiences and encouraging each other in their efforts to control *Striga*. Therefore, the efforts of Project coordinator Dr Mbwaga, Tanzania government and the donors are highly acknowledged for facilitating this exchange visit.

Prepared by M. Mwampaja
District Crop Officer Kyela.

ENHANCING PRODUCTIVITY OF UPLAND RICE ON STRIGA INFESTED SOILS OF TANZANIA

Village Meetings to design the Demonstration Program
Kyela-Matombo

A.M. Mbwaga- ARI Ilonga
C.R. Riches and R.I. Lamboll-Natural Resources Institute, UK

Project No. R8194 (ZA0511)
Project Working Paper No. 1

January 2003

CROP PROTECTION PROGRAMME

Preface

Striga species, the so-called witchweeds, are widespread on the fields of small holder farmers in semi-arid areas of Eastern and Southern Africa. These noxious parasitic weeds principally attack and reduce the yield of finger millet, maize, sorghum and upland rice in these regions. In many areas it is the crops of resource-poor households that are affected by these weeds. In Tanzania upland rice is attacked by *S. asiatica.* in a number of areas. Since 1996 staff from Ilonga Agricultural Research Institute and Sokoine University in Tanzania, and Natural Resources Institute in UK have been collaborating with district agricultural extension in studies aimed at developing integrated *Striga* management practices for the rice crop. Studies have been undertaken with two groups of rice farmers in Kyela District located in the Southern Highlands agricultural zone. Through on-farm trials the farmers came to appreciate that *Striga* infestation and poor rice production are associated with and indicators of low soil fertility. This in turn is a consequence of continuous rice cultivation in the absence of using any fertiliser or manure. While the trials demonstrated that up to a 60% reduction in *Striga* numbers and a 40% increase in rice yield could be achieved by using urea fertiliser farmers decided they did not wish to invest scarce cash in fertiliser. Instead they became interested in the opportunity, also observed from trials, to improve rice productivity on infested soils by introducing the green manure crop *Crotalaria*.

The current project "On-farm verification and promotion of green manure for enhancing upland rice productivity on *Striga* infested fields in Tanzania", operating from October 2002 to March 2005, aims to scale up the demonstration of using the green manure in rotation with rice in both Kyela (Mbeya Region) and Matambo (Morogoro Region).

The purpose of this report is to outline the initial activities of the project, which involved the formation of farmer groups, which will undertake demonstration in the 2003 rice-growing season.

Further information on the project or further copies of this report are obtainable from:

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Acknowledgement

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Contents

1. INTRODUCTION

Upland rice is an important cash crop in many areas of eastern and southern Tanzania, including Morogoro Rural and Kyela districts (Riches, 1999[1]). Under continuous cultivation, rice yields have been in decline in recent years. This is associated with falling soil fertility and an increase in infestation by the parasitic witchweed, *Striga* asiatica. In order to tackle this problem a group of researchers and extensionists have been undertaking trials in two villages in Kyela. Working with farmer groups in Kyela since 1996 it has been demonstrated that up to 60% reduction in *Striga* numbers and 45% increase in rice yield can be achieved by applying urea fertiliser (Mbwaga, 2001[2]). Although the farmer groups involved in the on-farm trials described how they had learnt through this work that *Striga* infestation is associated with low soil fertility they also indicated an unwillingness to adopt the use of urea as a widespread practice. This is largely due to a lack of liquidity for fertiliser purchase. Although a seasonal credit programme is available in Kyela, operated on a group basis through the district agricultural extension programme, many farmers consider the terms to be unfavourable. In particular loans have to be repaid at harvest time when rice grain prices are low. Another approach to managing *Striga* was therefore needed.

The green manure species *Crotalaria ochroleuca*, called Marejea in Kiswahili, has been grown for many years at St Benedicts Abbey, Peramiho, southern Tanzania, where it is used to maintain the fertility of organic gardens (Appendix 1). At Peramiho, this *Marejea* grows up to 2 m in height and has been found to be fairly drought tolerant, recovering well when rain returns. When broadcast as a sole crop growth is vigorous so that weeds is suppressed. This provides a clean entry for the subsequent crop. Seed obtained from Peramiho was distributed to the two farmer groups in Kyela by the research team and was planted at few sites by participating farmers in 2000. A number of farmers were familiar with *Marejea* as it had been included in on-farm trials undertaken in Kyela in a number of years before by Uyole Research Institute. For example according to farmers in Njugilo village a team from Uyole was active in Kyela in 1989-90 season. They are also aware of OFTs in near by Mbula village, which are said to have been operational in about 1996 for four seasons. These looked at using *Marejea* in rotation with upland rice. However the farmers view is that this was “just an experiment” and there seems to have been limited farmer participation and no follow up promotion. It is also understood that there has been little reporting of these field activities although a further search in the Uyole library may reveal grey literature covering the work.

Although farmers had expressed interest in testing the species further no seed was supplied. Farmers were very impressed by the growth of the plots planted in 2000, especially those placed on what was judged by the community to be poor, worked out land. Farmers took particular interest in one site where the farmer had planted sufficient *Marejea* to allow a comparison in 2001 of rice growth following the green manure compared to that following rice. Farmers observed that no *Striga* emerged on the plot previously sown to *Marejea*. This yielded 2100-kg ha^{-1} rice compared to 1000 kg where no fertiliser was used and 1600 and 1900-kg ha^{-1} respectively where 25 and 50 kg N ha^{-1} had been applied.

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[1] Riches C R (Ed.) 1999 Striga *distribution and management in Tanzania*. Proceedings of a stakeholder workshop, Dar es Salaam, 8-9 December 1999. Natural Resources Institute, University of Greenwich, UK.

[2] Mbwaga A M 2001 *Striga* research activities in Central, Eastern, Lake and Southern Highlands Zones of Tanzania: on-station and 0n-farm trials for 2000-01 season. Ilonga Agricultural Research Institute, Tanzania.

At a field day held in Kyela May 2001 and at results and planning meeting for 2001/2002 season in November 2001, both held in Kyela, farmers picked out the green manure plots and requested further support to test the use of *Crotalaria* more widely. Following village seminars conducted by Ilonga staff 33 farmers requested seed of *Crotalaria* to plant in the 2002 season. The District Agricultural and Livestock Development officer and village based extension officers held a farmer's day for non-participating farmers and arranged a farmer exchange visit, with farmers from participating communities in Itope/Busale and Kilasilo villages visiting each others fields.

The process of farmer evaluation of green manure, which was initiated by the research team, has subsequently become farmer driven. This has been built on to implement a new project designed to promote the use of the green manure *Crotalaria* for improving the fertility of *Striga* infested upland rice fields.

This project is led by Ilonga Agricultural Research Institute and is funded until March 2005. The current project will undertake field demonstration and other promotional activities in two districts of Tanzania – Kyela district in Southern Highlands Zone and Matombo division, Morogoro Rural district in Eastern Zone. In addition to Ilonga, local partners include district agricultural extension and education staff, the NGO INADES, which specialises in community analysis and empowerment and a soil fertility specialist from Mlingano Agricultural Research Institute. Natural Resources Institute, UK, are assisting with developing a protocols for monitoring farmer involvement in the demonstration work being undertaken by the project; development of the field programme, dissemination materials and monitoring of demonstration plots.

The project will use two routes to promote the soil fertility enhancement for *Striga* management. The major focus will be the formation of farmer groups, which will undertake on-farm demonstrations to be used as sites for field days. In addition there will be interaction with teachers at village primary schools in both districts. Awareness of the *Striga* problem and of methods to improve soil fertility will be included in agricultural science classes. Supporting training materials including posters and leaflets will be prepared as the need is identified.

2. BACKGROUND TO THE STUDY AREAS

Kyela district in Southern Highlands Zone

Rice is generally recognised as a very important crop in Kyela. The *Striga* research process has evolved quickly in this area at least partly in response to the enthusiasm of extensionists and farmers. One outcome of this has been limited socio-economic research under the Integrated Striga Research project. One particularly useful previous study was carried by a combined team from ICRA (International Centre for development oriented Research in Agriculture) and Uyole ARI (1994[3]). Part of the study involved a survey of 123 respondents across seven villages (five on the flood plain and two in higher areas).

Some background information:

- Kyela district -est. pop 159, 000 (1994); densely populated (est. 203 people/ sq. km in 1994)

[3] ICRA/ Uyole ARI (1994) A dynamic farming system: The case of Kyela district. Working document Series 37, Tanzania. ICRA, Wageningen, The Netherlands.

- High rainfall - annual average 2726 mm (1972-93).
- Kyela district can be broadly divided into flood plain (with high, middle & low benches) and higher land. Large areas of the flood plain are prone to flooding.
- Soils
  Flood plain: alluvial, poorly drained with high clay content;
  Higher land: weathered red clay; leached and acidic.
- Crops- household land allocation: rice (44%); home garden e.g. banana, cocoa (28%); other e.g. sweet potato/cassava (16%); maize (6%). Rice most favoured crop in Kyela - food and cash income.

Livestock - cattle numbers in decline. Pig and poultry increasing.

The District Extension Service has divided Kyela district into four agricultural ecological zones. According to Mr Mwambungu (DALDO) there are a total of 20 extension staff working at division, ward or village level in the district.

Some Farmer perceptions

Fertility status varies between villages (generally decreasing moving from flood plains to higher land). Weeding is most laborious task. Manure is associated with increase in weeds (5-15% of respondents). Weeds in general, particularly on the floodplain, considered a major constraint on rice production

Farmers classification of soils
In the higher areas, the ICRA study reports two main soil types *Kibumba* and *Ntitu*.

Local name	Kibumba	Ntitu
USDA classification	Ferrasols/ luvisols	Fluvisols
Location	Slopes	Valley bottoms
Colour	Red	Black
Texture	Clayloam	Clay
Water holding capacity	Poor	Good
Crops	Cassava, groundnuts, sweet potato, pigeon pea, bambaranut	Rice, maize
Fertility rank	2	1

Farmer knowledge
A high proportion of farmers has knowledge (through use) of chemical fertilisers and animal manure.
Discussion with farmers during studies undertaken by the DFID *Striga* project indicate farmers have little knowledge of Striga biology but associate it with declining soil fertility. The name for *Striga* in Kinyakusya is Kyumika

Upland Rice production practices
Cultivation- Ox ploughing (a male activity) is used by 70% of households across land types but by only 46% in upland areas. Other farmers use hand hoes.

Planting on both lowland and upland areas is by broadcasting over 2-3 months (to spread labour demand). Upland rice is planted in late December to early January, usually grown as a monocrop. Some farmers plant a sparse stand of pigeon pea within the rice.

Weeding is predominantly a female responsibility. 20% of respondents in the ICRA survey had used herbicides, most probably on lowland areas.

Harvesting of panicles in undertaken with a sickle.

Soil fertility management

Chemical fertilizer 54% of respondents have used at some time BUT following the national Economic Structural Adjustment Programmes, district sales of fertilizer (tonnes) by two main suppliers have fallen:

	KYERECU	RTC	TOTAL
1992	200	69	269
1993	2.5	25	27.5

Current use, based on discussions with farmer groups is thought to be low.

Up until recently there was high dependency on credit made available through IFAD project.

Crop Rotation- upland: 63% of respondents; Floodplain: 36%

Fallowing- practised by 50% of respondents - average period of 2 years.

Crop residues- grazed by cattle; used for thatch; burnt; Incorporated.
Rice fields: Hand hoe - residues burnt
Ox plough - incorporated

Animal manure
29 - 43% of respondents 'use ' animal manure but actual areas treated are thought to be small.

Constraints

Chemical fertilizer
The high price is generally considered as the major problem.
Response (Kg/ Ha) to fertilizer varies with location e.g.

	Without	With
Higher area (Lema)	198	395
Floodplain (Itunge & Mababu)	1186	1580

Difficulty with the credit conditions associated with the IFAD project reduces the attractiveness of this route into fertiliser purchase. These include the need for group membership and particularly the need to re-pay the loan at harvest time when rice prices are low (has been 250% variation in farm gate price for paddy over season).

Animal manure
Insufficient quantities and the distance to fields constrain widespread use of animal manure.

Time to walk to fields (minutes)

	Flood	High
Rice	45	55
Maize	30	15
Cass/SP	15	7

Some negative perceptions are associated with increased weed growth following use of manure.

Matombo division, Morogoro Rural district in Eastern Zone

Morogoro Rural district has a population of about 600,000 and is to be spilt in two becoming Mvomero district in the north (4 divisions) and Morogoro Rural in the South (6 divisions). Matombo lies to the south in the area of the Uluguru Mountains. A study by Bhatia and Ringia (1996[4]) provides some useful background to the Uluguru mountain area. PRAs were carried out in 11 villages, one of which was Kiswira (one of the project villages).

The Uluguru mountain area in general is relatively densely populated (more than 150-persons/ sq. km) and has a high rate of population increase (up to 6.5% per annum). The area is most inhabited by Waluguru people whose livelihoods are reported to be based on subsistence farming –particularly maize, beans and rice and, from selling vegetables and fruits to urban markets.

The mountains rise from about 300m at the coastal plain to 2638m. Rainfall varies from 900m at Morogoro municipal to 1200-3100m on the drier western slopes to 2500-4000 m on the eastern slopes. There are generally two rainy seasons with the long rains (*Masika)* usually from February to June and the short rains (*Vuli*) October-January. The forests on the Ulugurus are considered to be one of the top priorities for biodiversity conservation in Africa, as well very important as catchment areas for rivers, maintaining a humid climate and preventing soil erosion. There is a long history of external interventions aiming to conserve natural resources in the area.

Deforestation and other resource degradation are attributed to land scarcity. The system of land ownership at the time of the study was based on lineage systems, which is reported to lead to inequitable distribution, land scarcity and poor land management. Some families suffer from land shortage; others hold land, which is not being used. Some farmers are tenants, paying in cash or kind, and they are restricted from practising permanent land development, including planting of trees. According to Bhatia and Ringia (1996), Kiswira was identified as a special case where the land for the village is leased from the Catholic mission (dating back to the time of Tanzania's villagization programme). Under this arrangement all trees planted belong to the mission and a percentage of any produce (*ngoto*) from the farms also has to be paid to the mission. A diverse range of crops is grown for food and cash in a number of cropping systems (see below).

Season/ type of shamba	Long rains (*Masika*)	Short rains (*Vuli*)	Dry season (*Kiangazi*)
Hilly/ forest fields (*Mwituni*)	Maize/ rice relay (upland rice) Vegetables, potatoes, yam, cassava Bananas	Maize/rice relay Banana, beans Yam, potato	Woodlots Banana
Home gardens (*Jaladani)*	Intensive agro-forestry, banana, fruit trees, multi-purpose trees, beans, peas, livestock, maize, sweet potato	Maize and beans Banana and multi-purpose trees Small livestock	Agroforestry Multipurpose trees and banana

[4] Bhatia Z. and Ringia O. (1996) Socio-economic survey of selected villages in the Uluguru mountains, Tanzania. Uluguru slopes planning project Report No. 3. A joint project between Government of the United Republic of Tanzania, the European Union and the Royal Society for the Protection of Birds.

Valley bottoms (*bustani*)	Maize and rice Banana Beans	Maize/ rice relay Agroforestry	Irrigated/ residual moisture crops: Vegetables, maize, beans
Lower plains (*makondeni)*	Maize and cow pea Sorghum and cassava	Early maturing maize, cowpea, pigeon pea	Grass/ bush fallow

Inter-cropping is common. Maize is produced in all zones, but is not sufficient to meet food needs. Low yields are attributed to low soil fertility, low yielding local varieties, pests and diseases, particularly vermin. Rice appears to be cited as a food crop rather than a cash crop. Weeds in general are cited as a problem (growing fast in response to the favourable climate) and difficult to control, although *Striga* is not specifically mentioned in the report.

Shifting cultivation is still commonly practised although fallow periods are generally much reduced and in some areas land is cultivated continuously. The majority of farmers practise flat cultivation with contours constructed using grass, shrubs and trees. Bench terraces and other soil conservation practices are unpopular and are considered unproductive, labour intensive and less effective in erosion control than indigenous practices. Minimum or zero tillage is often practised especially on hilly fields. Hand hoes are the main tools for cultivation. Due to the presence of weeds, fire is used in many places to facilitate land preparation.

Most households in the Ulugurus experience shortage of cereal food, particularly maize. Households supplement home produced maize with maize imported from Kilosa and Iringa.

During the PRA constraints were identified and prioritised in seven villages. 18 major constraints were identified: Communications, Hospital/health, Land scarcity, Mine ownership, Education/schools, Lack of milling machines, poor upbringing of youth, clean and safe water, lack of markets, poor agriculture/forest extension, vermin, poor village leadership, deforestation, unemployment, high cost of agricultural inputs, corruption of officials/leaders, lack of credit facilities and pests and diseases. In Kiswila village the top 6 constraints were ranked as Hospital/ health, Lack of milling machines, Vermin, Clean and safe water, Communications, Lack of markets. Loss of soil fertility due to shorter fallows was specifically mentioned in the Kiswira PRA. Manure is not used because of insufficient livestock. Villagers are discouraged from erosion control practices such as planting 'kaskas' because they feel this would reduce land availability for cropping even further.

In Morogoro rural district there are 235 villages and 132 extension staff outside the district HQ. The aim is to have at least one extension officer in each ward.

3. VILLAGE SEMINARS AND FARMER GROUP FORMATION

Initial village meetings were held in Kilasilo, Itope and Sinyangu (Kyela), Kiswira, and Kibangile (Matombo) during mid-September and in Njugilo in Kyela in November. Staff from the district extension office opened meetings. There then followed a discussion on the crops grown and identification of production constraints. Following this Ilonga staff made a presentation on *Striga* control and options for improving soil fertility. A possible layout for demonstrations was discussed and farmers willing to be involved were facilitated to form a group and to vote for group leaders. The meeting agenda followed is shown in Appendix 2. The existing *Striga* research groups in Itope and Kilasilo, who already have pots of *Marejea* were updated on the new project and plans were agreed for the coming season.

Kilasilo

The team consisted of Dr A Mbwaga (ARI Ilonga), Dr. G. Ley (ARI Mlingano), Mr. J. Kayeke (currently a Student at Sokoine University of Agriculture), Dr. A. M. Mbwaga (ARI Ilonga), Mr Mwambungu (DALDO Kyela), Mr Mwaipaja (DCO-Kyela) and Mr Mwangosi (VEO - Kyela).

Kilasilo village is entering in the third phase of working on *Striga* management. The Chairman of the Farmer Group (Mr. Mwaseba) briefed the team on the activities undertaken during the 2001/2002 season.

The activities included
1. Multiplication of *Crotalaria* seed for the 2002/2003 season
2. Evaluation of the performance of the pigeon pea cultivars (ICEAP 0068 and ICEAP 00068) for wilt resistance and yield.
3.

Farmers reported to have produced enough seed of Crotalaria, which they are ready to share with other farmers who are either, new or they did not harvest enough from their fields during the season.
Pigeon pea needed spraying against flower sucking insects. Those farmers who did not spray had poor harvest, but those who sprayed they harvested between 6-8kg/50m^2.
3. *Ramphicarpa fistulosa* is a problem in lowland rice. Plots sprayed with 2, 4D plus Ronstor performed the best and farmers are requesting to find the availability and price of the chemical so that they can share the cost of buying the chemical.

Plan for the coming season 2002/2003:

1. They will continue with evaluation of pigeon pea, as only five farmers had participated last season. Next season every farmer would like to try plots of pigeon pea.
2.The plots, which were under *Crotalaria*, are to be grown with rice to see effect on *Striga* and rice grain yield.
3. Plots which were under pigeon pea last season are to be planted with rice and to evaluate its effect on *Striga* numbers and rice grain yield compared to where there was continuos rice.
4. Increase number of farmers from 5 to 10 to continue with evaluation of herbicides on control of *Ramphicarpa fistulosa*.

Briefing on the New project i.e. promotion of green manure

The farmers were briefed on the start of the new phase of the project with objectives of scaling up the use of *Crotalaria* to improve soil fertility and control of Striga as they had earlier requested from the former project. They were briefed also on the research team composition, activities to be carried out and the role of their group for the new joining farmer groups from within Kyela and Matombo – Morogoro. They were requested to receive fellow farmers from new villages and from Matombo-Morogoro to learn how to grow Marejea, to learn its effects on Striga and increase of soil fertility – hence increase rice grain yield. They all responded very willing to receive and show other farmers on the technology on the advantage to use *Crotalaria* instead of inorganic fertilisers. Twenty farmers participated at this meeting, but we were told that they are 25 farmers in total.

Group registration

The group is in the process of developing a constitution for formal registration Each farmer member is contributing 5 000 Tsh as entry fee. The group is called **KIMBALU.**

Demonstration Plots for 2002/2003

5 x 30 m each

Crotalaria plot	Rice plot

Itope (Chilambo)

On the same date in the after noon the team visited Itope (Chilambo) and met farmers. The number of farmers was much small compared to Kilasilo, because other farmers were involved in other National activities at that day. The chairman of the group briefed the team on the activities of the 2001/2002 season. Majority of the farmers did not plough under the *Marejea* plots but harvested enough seed to be used for the demonstration plots in the 2002/2003 season.

Their pigeon pea performed poorly due to water lodging and late spray against pod borer insect pests.

Activities for the next season

Plots planted with Crotalaria last season will be planted with rice and compared to those planted with rice to evaluate *Striga* infestation and rice grain yield. Similarly those plots, which were under pigeon pea, will be cultivated with rice to see effect of preceding crop on Striga emergence and grain yield of rice.

The group was also briefed on the new phase of the project and it was happy to have the project to continue and promised to involve more farmers to participate as way of scaling up. For the coming season 2002/2003, the group decided for each participating farmer to have a plot size of 10 x 30m. The number of farmers who participated at this meeting was only 9 out of 12 in the group. The plot layout will be as in Kilasilo.

The group is also going to receive two pigeon pea varieties to plant, each farmer ¼ kg ICEAP 00068 and ICEAP 00040.

Sinyanga

This was not a very convenient day to visit this village which is new to the programme. It was Sunday and majority of the farmers had attended church services and also it was a market in the village. 12 farmers attended the seminar.

Information gathered from the farmers

Farmers in the village grow maize, lowland flooded and upland rice. Pigeon pea is an important legume. The major problem reported on crop production was low soil fertility and *Striga*. Farmers have observed *Striga* on cereal crops grown on sandy soils, elevated areas, and fields with low soil fertility. The *Striga* problem has been increasing over the years and farmers think the problem has been caused by continuos growing of the same crop on the same field year after year. The effect of *Striga* on the crop was reported to be stunted growth, scorching of the crop leaves, and poor grain yield (from 10 bags of rice in the past to 3-2 bags/acre now). *Striga* starts emerging after the 1st weeding around February/March and initial symptoms start with yellowing of leaves.

Efforts of Striga control

Application of farm yard manure for farmers having cows
Weeding the Striga
Rotation of crops especially maize with groundnuts
Leave land fallow for 2 years

From the discussion non-of the methods listed reduced Striga problem completely.

The relationship between *Striga* and the crop from farmers point of view

-*Striga* utilises much of the water from the soil hence deprive the crop for water
-*Striga* has a special way of affecting the crop
-*Striga* attaches itself to the roots of rice crop.

This last point was the entry point for educating seminar participants on the *Striga* biology and control options.

Farmer research group formation

12 farmers volunteered to participation in the trial demonstration.
Mr Lusekelo Kawilo elected chairman of the group
Ms Mbutolwe Panja elected secretary of the group

Demonstration plot size

Each farm size: 5m x 20m with one plot of *Crotalaria* and one of rice.

Njugilo village

Research team consisted of Dr Mbwaga, Dr C Riches, Dr G Ley, Mr R Lamboll, Mr P Lameck, Mr J Kayeke, Mr A Mwambungu (DALDO- Kyela) H Mwangosi (WEO) A Mwakalinga (DVEO)

The session started by self-introduction, the farmers, researchers and District officers Then a situation analysis was done to explore information related to crop production in order to introduce S*triga* awareness and *Striga* control measures in the form of Participatory Technology Development**.**

Crops grown: Rice, maize, cassava and ground nuts

Rice varieties grown: Kilombero and Mwangulu (Lowland and upland production systems are common in the village)

Yield of rice obtained/acre: Years ago farmers used to get 5 –8 bags per acre but now farmers get 3 –4 bags per acre

Production constraints:
Rice Yellow Mottle Virus (RYMV) in low land rice
Striga in upland rice and maize
Low soil fertility
Weed infestation in rice (Cynodon spp)
Birds in rice fields
Cutworms and ants on upland rice

***Striga* history**:
The witch weed has been in the village long time ago, but it is increasing because of low soil fertility, seed multiplication, use of ox-plough and climate changes (Low rainfall)

Indigenous control measures:
Early planting, one-year fallow, hand pulling and the use of animal manure. The later is not common because of the bulkiness of the manure and the distance to the rice fields.

Farmers knowledge on *Striga*:
Farmers were not aware of the *Striga* biology and how *Striga* affects crops. There was no specific use of the witch weed. The spread was known to be by seeds moved by water, cattle and ox-plough.

Then farmers were taught the biology of *Striga* and Integrated Control Measures. After Participatory technology Development farmers agreed to use *Crotalaria* and Pigeon-pea to improve soil fertility at the same time control *Striga* in their rice fields. The agreed plot size was 5x20m**.**

Matombo, Morogoro rural

The team, which visited Matombo consisted of C. Massawe and A. Mbwaga (ARI Ilonga), Mrs Masangya (District information officer represent DEO) and H. Amir (VEO – Matombo).

<u>Kiswira village</u>

In the morning starting from 9 am to 1.30pm the team had a seminar with the Kiswira village farmers. 17 farmers attended the seminar and at the end of the seminar all volunteered to participate in the demonstration and evaluation of the green manure technology.

Crops grown

Maize
Upland rice, Cassava, and sorghum

Production constraints

Diseases
Stem borer (Messo)
Striga (Sani)
Storage pests
Army worms
Decline of soil fertility.

Crops attacked by "Sani" (Striga)

Maize
Upland rice
Sorghum
Hanakolo (creeping weed on cassava).

Symptoms on the crops attacked by Striga

Stunted growth
Yellowing and drying of the leaves
Reduced grain yields (barren heads).

Striga control measures practised by farmers

Leave land fallow for at least 3 years
Deep ploughing
Crop rotation cereal with cassava or sesame
Use of animal manure (very few farmers practise due few animals)

Uses of Striga

No uses

Farmers perception on the relation ship between Striga and host plant:

Striga produces poison, which affects the cereal crop
The weed attaches itself to the cereal roots and draws water and food and hence affects the crop. From here farmers were educated on the biology and available Striga control options.

Group formation

All 17 farmers who participated at the seminar volunteered to participate in demonstration and evaluation of the Marejea and pigeon pea technology. The group was named "Tuwalole" meaning "let us watch you".
Mr. Jorge Mkami was elected chairman of the group.
Mr. Adolf Mawango was elected secretary of the group.

Agreed plot sizes would be 5m by 10m. It was further agreed there would be 4 plots at each site. These would be rice, marajea, pigeon pea and "kiraka". The latter is a green legume first brought to the village, for use in coffee, by a British Agricultural Officer in about 1954. From samples brought to the meeting this appears to be the legume *Pueraria phaseoloides* ("kudzu"). Although not used by farmers, plants have persisted in the area and farmers decided to collect seed to use on the plots.

Parameters to evaluate:

Soil fertility (vegetative growth)
Striga intensity
Rice grain yield

<u>Kibangile Village</u>

16 farmers participated at the seminar.

Cereal Crops grown in the village:

Maize
Upland rice
Sorghum

Production Constraints:

1.Weeds
-Striga "Sani"
-Cyperus SP
2.Low soil fertility
3.Vermin (Ngedere, Nyani and Kima)
4.Poor agricultural working tools

Crops affected by *Striga:*

Maize
Sorghum
Upland rice

Symptoms of *Striga* on the host plants:

Yellowing of the leaves
Stunted growth
Reduced grain yield

History of Striga:

It is as old as the crop and observed 1953 explained from one of the aged farmer

Reasons for increase:

-Decline in soil fertility
-Reduced fallow periods as the population of people increased
-Cropping of the same type of crop year after year

Control measures practised by farmers:

-Deep ploughing
-Crop rotation
-Early planting
-Leaving land fallow for at least 3 years
Weeding

The relationship between *Striga* and the cereal crop from farmers perception.

-*Striga* roots suffocates host roots
-Compete with host plant for water and food

-Produce poison to affect the host plant
-*Striga* roots are stronger than those of the host plant, they attach themselves to the host plant and absorb water and nutrients from the host. This was the entry point to talk about Striga biology and control options.

Group formation
All seminar participants volunteered to participate on demonstration of the Marejea technology.

Plot size agreed:
5m x 35m

Observations:
Soil fertility by looking at the vegetation of the crop
Striga population
Rice grain yield

Leadership
Filbert Roman was elected chairman of the group
Josephene Amosi was elected secretary of the group

4. FOLLOW UP MEETINGS:

The project team, including Dr Riches and Mr Lamboll from NRI and Mr Lamek of INADES, visited all the participating villages again in November 2002. This provided an opportunity for farmers to meet the whole team and for issues on the biology and control of *Striga* to be clarified. Demonstrations plans suggested at the seminars were confirmed.

5. MONITORING AND EVALUATION

Discussions among the project team identified a number of reasons why monitoring is important. These included:

1) To understand why or why not farmers are participating in the demonstration programme and are adopting the technology;
2) To generate information to use in the preparation of promotion material;
3) To provide information to the donor.

Baseline data collection

The community situation analysis, led by INADES and scheduled to take place in January 2003, will provide an opportunity to gain a much better understanding of the communities with which the project is working. Either as part of this exercise or in addition to it, it would be very useful to characterise the population of the villages in terms of some key criteria, particularly poverty. A relatively easy way of doing this would be through a wealth ranking exercise. This will provide an understanding of how the community perceives wealth/poverty and through the use of a random sample an indication of the proportion of the community in broad wealth groups. This would allow the project to see which farmers we are currently working with and whether or not different target groups should be identified which will have different needs and approaches to addressing soil fertility/ *Striga* constraints.

The communities may also be characterised through a questionnaire survey similar to the one used in the Integrated management of Striga project. This includes some indicators of wealth/ livelihood status (these may have to be modified following the wealth ranking eg cattle are fairly scarce in the Ulugurus) and a few questions relating to access to and management of soil resources. The sample should be random to represent

the community. If the resources allowed participating farmers could also be interviewed to give an indication of the wealth groups represented by participants hosting demonstration plots. A draft questionnaire (which will need to be modified after wealth ranking) is included in Appendix 4.
Farmers' perceptions of soil resources appear to be very important and the project would benefit from a clear understanding of farmers' soils classification. This again could be part of the community situation analysis to be carried out in January.

Either as part of the baseline survey or the situation analysis it would appear to be important to learn from previous initiatives. One clear example appears to the experience of Uyole ARI with *Crotalaria* and rice in Mbula village (about 3 km from Njugilo village). As mentioned above it was reported that Uyole had trials in Mbula village for 4 years from 1996. It would be good to see what could be learnt from participants in that village.

Monitoring the process

It would very useful to systematically record activities at the project sites and how these are reported. This may be particularly useful when a wide range of individuals and organizations are being asked to carry out activities.   An example of a possible format is shown below. This could also be used to plan out activities and reporting over the next 12 months and, at a more general level, until the end of the project.   The first document produced reporting seminars and farmer group formation provides a good example of the type of information to be recorded.

Project activities to date

Activity	Who participated	Location	Date	How reported
Seminar and farmer group formation		Kyela district: Kilasilo Itope (Chilambo) Sinyanga Njugilo (9th November 02) Matombo, Morogoro Rural district: Kiswira Kibangile	19th-23rd October 02	Internal project document to be upgraded to working paper?
Teachers seminars		Kyela district: Matombo, Morogoro Rural district:	7th November 02 11th November 02	Internal project document
Follow-up visit to participating villages		Kyela district: Kilasilo Itope (Chilambo) Sinyanga Njugilo (9th November 02) Matombo, Morogoro Rural district: Kiswira Kibangile	8-9th November 02 12th November 02	
Planting of demonstrations				Report from District Extension/ Framers?
Community situation analysis				Report from INADES?

Possibilities of setting up a participatory monitoring system with farmers, extensionists and others should be explored in the community situation analysis workshop. Such a system clearly depends on participants having an incentive to monitor activities. If no such incentive exists, then the project will need to allocate responsibilities and resources to people/ organisations able and willing to carry out the job. This again could be decided around, if not part of, the community situation analysis workshop.

Some thought needs to go into how to monitor and evaluate the outcome of promotion through teachers and schools. In particular, does the message/ technology pass from children to parents or others in the community. This may require a specific targeted study towards the end of the project.

Monitoring demonstration plots

The discussions with participating farmer groups have led to agreement on implementation of a series of field demonstrations. The main aims for these is to provide a focus for farmer evaluation AND a farmer training aid for wide-scale promotion of using either *Crotalaria* or pigeon pea in rotation with rice. To date the project has viewed *Crotalaria* as a tool for enhancing soil fertility and reducing *Striga.* Farmers who are gaining experience with the cover crop in Kyela are reporting that it also suppresses weed growth and that less weeding is needed in a rice crop following *Crotalaria* than in continuous rice. On the other hand the green manure needs to be incorporated into the soil. Some farmers have done this by making ridges with a hoe, others have ploughed in the biomass with an ox drawn plough. These experience need to be captured and documented so that they can be incorporated into updated extension materials as the project proceeds. A suggested proforma for collecting information from each plot is attached in appendix 5. As the layout of the demonstrations may vary from site to site it is suggested that one sheet is maintained for each plot. Greater ownership of the demonstrations by the community can be encouraged if a member of the farmer group agrees to maintain the records. This process will need to be overseen by the village extension worker. If for some reason the farmer-recorder can not continue this work IT MUST BE adequately undertaken by the extension worker and/or project staff.

6. SCALING-UP

The project is currently opting for district extension, teachers and farmer-farmer approaches to scaling up. One way to identify other possible options would be to carry an AKIS (Agricultural Knowledge Information Systems) or equivalent study again perhaps as part of the Community Situation analysis workshop. This could identify key players and approaches to scaling up relatively quickly.

The demonstration plots will provide sites for field days. District extension staff should be encouraged to use these to promote the concept of *Striga* management through soil fertility enhancement to the wider farming community. Supporting extension literature will be needed to hand to interested farmers. A leaflet showing the main points which need to be disseminated will be drafted. This will need to be translated into local languages and tested with farmers to ensure it contains the information which farmers need. Use of the term *Striga* will need to be substituted by the appropriate local name.

7. INVOLVING SCHOOLS

Seminars for primary school teachers from villages in Kyela and Matambo were held in November. Teachers were presented with an overview of the *Striga/*soil fertility problem and the project plans to undertake a demonstration programme on the use of green manure. Mr Lamek undertook a situation analysis with them to identify the usual sources they use for teaching materials and information and to identify constraints. Subsequently the teachers proposed ways that they can become involved in raising awareness of *Striga* management in their communities. These include teaching at school, by having a school demonstration plot and by speaking at village meetings. Posters showing the *Striga* life cycle and control measures were distributed with leaflets and a training manual summarising aspects of the biology and control of *Striga*. It was agreed to meet both teacher groups again in May to discuss their progress. Full details of the seminars and follow-up activities will be presented in a future working paper.

Appendix 1. A Popular Multipurpose Green Manure in Tanzania

Crotalaria ochroleuca, an annual legume from Africa commonly known as Marejea, or sunnhemp, has emerged as a promising under exploited crop. Vol 3. No.1 of the ILEIA Newsletter reported on this promising legume. Recently, Fr. Gerald, a Benedictine missionary in Tanzania published a manual on Sunnhemp, called Sunnhemp/Marejea, which covers the many beneficial characteristics of this plant.

Among sunnhemp's many uses are the following: green manure, nitrogen fixation, weed suppression, livestock forage, and pest control. Farmers in Tanzania have found tillage easier in fields where sunnhemp has been grown and incorporated into the soil, due to improved soil texture. These farmers can plough their fields before the rains, giving crops the benefit of the full rainy season, improving their chances of a successful harvest. Sunnhemp's deep root system aerates the soil and increases water Infiltration. The deep roots also retard soil erosion.

Nitrogen fixing rhizobium associated with these roots, fix atmospheric nitrogen normally unavailable to plants. Professor M. P. Salema of Sokoine University of Agriculture, Morogoro, has isolated superior kinds of rhizobium for improved nodulation on sunnhemp. By inoculating their seeds with the rhizobium farmers can now increase their production.

Nitrogen that has been fixed by the soil rhizobium is made available to crops by composting sunnhemp or turning it into the soil in situ. The organic matter added to the soil also improves soil moisture retention and texture. Cut sunnhemp can be used as a mulch to suppress weed growth and to control erosion. Ultimately the sunnhemp mulch will decompose, adding nitrogen to the soil to benefit succeeding crops. Sunnhemp's low carbon to nitrogen ratio causes it to decompose readily, quickly adding nutrients to the soil. Sunnhemp, unlike most nitrogen fixing legumes, performs well on poor and acidic soils. For this reason farmers in Tanzania have used sunnhemp to revitalise weedy or infertile fields

In addition to its soil improving qualities, sunnhemp also controls weeds. Under appropriate conditions sunnhemp establishes quickly and grows abundantly, thus out competing weeds. If planted densely, sunnhemp prevents weed growth in the first year, and reduces subsequent weed growth for the following 1-3 years. Sunnhemp can out compete couch grass (Digitaria SP) but not blackjack (Bidens pilosa). Over the course of 3 years sunnhemp eventually out competes stargrass (Cynodon SP) in paddies.

The same rapid, abundant growth that out competes weeds also controls erosion. Planting sunnhemp between crops, both spatially and temporally, maintains a continuous plant cover, which stabilises the soil and breaks the impact of raindrops. Since sunnhemp is drought tolerant, it is able to protect the soil when rains begin again.

Cultivation of Sunnhemp

Experienced sunnhemp farmers mix 10 kg of seed for each 0.5 hectare to be planted with sand or dry soil at the ratio of 1: 2 litres to assure a proper planting density (plants spaced 10-15 cm apart). Above ground growth is slow initially, as the plants develop deep roots. Eventually sunnhemp reaches a height of two meters or more, and flowers appear three or four months later. Sunnhemp does not re-seed itself, since its pods stay closed after the seeds have matured, even protecting them for months into the rainy season. After six months the plants begin to senesce. The stems, however may persist for as long as eight or nine months, and will develop new leaves when cut one foot above ground, or when eaten by animals.

Other Uses of Sunnhemp

Sunnhemp can be grown as a fodder crop. Farmers in Tanzania have found that sunnhemp can constitute 60% of their cattle's feed. The stems that are left over are mixed with manure to compost them. Chicken will eat any part of the sunnhemp plant except for the seeds. One acre can yields up to 100 to 300 kilos of seeds; one kilo seed sells at 25/shillings in Tanzania. Some farmers let their cattle graze sunnhemp for one hour a day if they do not want to harvest the seed. Sunnhemp can also be used to feed tilapia.

According to farmers' observations, sunnhemp controls nematodes, which attack tomatoes. Farmers plant sunnhemp about four months before planting the tomatoes. Cut the sunnhemp and dig it in to the soil one-month before planting the tomatoes or when the sunnhemp is about one meter high. Sunnhemp also hosts a beneficial insect, the earwig. Earwigs enter stem borer tunnels in search of larvae. Occasionally they climb the foliage to prey on leaffolder larvae. Earwigs can consume 20-30 prey daily, and live 3-5 months. Farmers in Tanzania have noticed few harmful insects in fields where sunnhemp is inter-cropped with maize.

Farmers in Tanzania have discovered several successful management techniques for growing sunnhemp in association with their food crops. Some farmers plant single stands of sunnhemp before and after maize when chemical fertilizer is unobtainable. Although an extra ploughing is required to plant the sunnhemp, weeding is reduced, and maize yields are higher. Other farmers sow sunnhemp along with maize, and incorporate it into the soil when it nears the height of the maize.

Farmers who rotate sunnhemp with maize or sorghum plough the sunnhemp under at flowering. At this stage the sunnhemp has accumulated near to maximum amounts of nitrogen, and the biomes is still succulent enough for fast decomposition and release of nutrients. In very poor soils sunnhemp improves soil fertility most when the mature plant, including the seeds, are incorporated into the soil.

Sunnhemp can also be used in a rotational planting schedule along with rice and beans. Sunnhemp is planted in the rice fields at the time of the first rice weeding. The sunnhemp is still short when the rice is ready for harvest. After harvesting the rice, sunnhemp covers the field, and is ploughed in before planting beans. Farmers in Tanzania have found these method quite effective in controlling weeds. A later issue will feature a community where Sunnhemp is used as a fertilizer, and its seeds are valued as a cash crop.

For more information, or to order a copy contact:

Fr. Gerold Rupper, O.S.B.
Sunnhemp Seed Bank
Bos 1, Peramiho Tanzania

Appendix 2

The content of village seminars

1. Understanding cereal crops grown by farmers
2. Production constraints
3. Striga problem
   Types of crops attacked by Striga
   Biology and ecology of Striga
   Damage symptoms caused by Striga and effect on crop yield
4. Control measures practised by farmers themselves
5. Introduction of already available Striga control options and their limitations depending on locality
6. Why Green manure as an option for increase soil fertility and Striga control
7. Reason for scale up on the use of Crotalaria experience from Kilasilo farmers in Kyela
8. Lay out of the demonstration/evaluation plots

9. Volunteer Farmers i.e. willing to participate in the demonstration/evaluation plots
   Democratic election of Group Chairman
   Democratic election of Group Secretary
10. Distribution of Crotalaria seed @1kg for participating farmer
   Distribution of ¼ kg of pigeon pea to be included in the fertility improvement (ICEAP 00040 - late and ICEAP 00068 – medium maturing)

Appendix 3. **Village Group membership**

Kilasilo village - Kyela

No.	Farmers Name	Sex	Position
1	**Asegelisye Mwaseba**	**male**	**Chairman**
2	**A. Aliko**	**male**	**Secretary**
3	**P.K. Fumbo**	**male**	**Member**
4	**A. Mwandenuka**	**male**	**Member**
5	**E.R. Mwaipopo**	**male**	**Member**
6	**A.L. Mwakanyasi**	**Male**	**Member**
7	**Lea Kyusa**	**female**	**Member**
8	**Kibalika Mwandenuka**	**male**	**Member**
9	**Ezekiah Mwakapona**	**male**	**Member**
10	**Alfred Mwamudeza**	**male**	**Member**
11	**Jaili Mwakatage**	**male**	**Member**
12	**Tusajigwe Isumo**	**female**	**Member**
13	**Flora Mwaseba**	**female**	**Member**
14	**Ruth Mwakibole**	**female**	**Member**
15	**Saidia Mwkafyuju**	**male**	**Member**
16	**Oscar Mbonge**	**male**	**Member** *
17	**Benard Mwakalinga**	**male**	**Member**
18	**Angumbwisye Mwakesa**	**male**	**Member**

- ***Village government Chairman**

Itope village – Kyela

No.	Farmers Name	Sex	Position
1	**E. Mwang'onda**	**M**	**Chairman**
2	**A. Mbalangwe**	**M**	**Member**
3	**Mwema Hamisi**	**M**	**Member**
4	**Hamisi Mwema**	**M**	**Member**
5	**Rehema Mwalaba**	**F**	**Member**
6	**Christipher Mwaisabila**	**M**	**Member**
7	**Yusufu Kayuni**	**M**	**Member**
8	**Elizabeth Kahuka**	**F**	**Member**
9	**Upendo Haule**	**F**	**Member**

Sinyanga village - Kyela:

No.	Farmers Name	Sex	Position
1	**Lusekelo Kawilo**	**M**	**Chairman**
2	**Mbutolwe Panja**	**F**	**Secretary**
3	**Henry Simfukwe**	**M**	**Member**
4	**Robinson Kiposolo**	**M**	**Member**
5	**Abel Mwakalinga**	**M**	**Member**
6	**Israel Mwijande**	**M**	**Member**
7	**Boscal Mgetile**	**M**	**Member**
8	**Andwele Mwalukimba**	**M**	**Member**
9	**Angumbwisye Mwakipesile**	**M**	**Member**
10	**Lupakisye Mwamakula**	**F**	**Member**
11	**Godon Mwakibambo**	**M**	**Member**
12	**Atupele Chinganya**	**M**	**Member**

Njugilo village - Kyela:

No.	Farmers Name	Sex	Position
1	**Robert Mwailubi**	**M**	**Chairman**
2	**Twitike Jungwa**	**F**	**Member**
3	**Aden Mwakatabale**	**M**	**Member**
4	**Jason Mwasege**	**M**	**Secretary**
5	**Philemon Mwakasege**	**M**	**Member**
6	**Francis Mwalyagile**	**M**	**Member**
7	**Steven Mwanjalaba**	**M**	**Member**
8	**Edson Mwapasi**	**M**	**Member**
9	**Jackson Salim**	**M**	**Member**
10	**Andwele Mwakasege**	**M**	**Member**
11	**Frank Mwaisumo**	**M**	**Member**
12	**Jacob Mwaijobile**	**M**	**Member**

Kiswira village -Matombo

No.	Farmers Name	Sex	Position
1	**George Mkami**	**M**	**Chairman**
2	**Germana Peter**	**M**	**Member**
3	**Patrick Francis**	**M**	**Member**
4	**Otto Nzeru**	**M**	**Member**
5	**John Msimbe**	**M**	**Member**
6	**Alloyce Dominick**	**M**	**Member**
7	**Vicent Midongo**	**M**	**Member**
8	**Paulo Mloka**	**M**	**Member**
9	**Adolf Mawango**	**M**	**Secretary**
10	**Michael Roman**	**M**	**Member**
11	**Felista Rock**	**F**	**Member**
12	**Simforosa Michael**	**F**	**Member**
13	**Enstaki Theodory**	**F**	**Member**
14	**Lydia John**	**F**	**Member**
15	**John Yully**	**M**	**Member**
16	**Albetina Thomas**	**F**	**Member**
17	**Wilvina Dimoso**	**F**	**Member**
18	**Herriel Amir**	**M**	**VEO**

Kibangile Village - Matombo

No.	Farmers Name	Sex	Position
1	**Filbert Roman**	**M**	**Chairman**
2	**Adam Ally**	**M**	**Member**
3	**Ally Shomary**	**M**	**Member**
4	**Salum Mizambwa**	**M**	**Member**
5	**Mohamed Ally**	**M**	**Member**
6	**Josephina Amosi**	**F**	**Secretary**
7	**Yahaya Selemani**	**M**	**Member**
8	**Jumanne Rashid**	**M**	**Member**
9	**Mzeru mbaruku**	**F**	**Member**
10	**Juma Hussein**	**M**	**Member**
11	**Hussen Mbaruku**	**M**	**Member**
12	**Anjela Aloyce**	**F**	**Member**
13	**Salehe Ahamadi**	**M**	**Member**
14	**Gabriel Joseph**	**M**	**Member**
15	**Thomas John**	**M**	**Member**
16	**Abdul Rajabu**	**M**	**Member**

Appendix 4: FARMER QUESTIONNAIRE

District…………………………………..Village………………………..

1. **Farmer information**

Name:…………………………Age:…….. Sex:………Relationship to head of household:……………

2. **Livelihood situation**

2.1 Livelihood group……….. 2.2 How many cattle do you own?....... 0; 1-5; 6-10; >10

2.3 a In the past 12 months have you hired in labour? YES/ NO?
b On what basis do you hire labour? (eg cash, food)……………………..

2.4 a In the past 12 months have you hired out your labour? YES/ NO
b On what basis do you hire out your labour? (eg cash, food)……………………..

2.5 (a) In the past 12 months for how many months did your household have enough food?……months
(b)In a GOOD year for how many months does your household have enough food?……….months
(c) In a BAD year for how many months does your household have enough food?…………months

2.6 (a) Do you have any sources of non-farm income? YES/ NO
If YES (b) What are your sources of non-farm income?……………………………………………….
(c) Approximately what proportion of your income comes from non-farm sources?
(1) 0 (2) > 0 <= ¼ (3) > 1/4 < =½ (4) >1/2 <=3/4 (5)>3/4 < All (6) All

2.7 How do you cultivate/ prepare the ground for upland rice?
(1) Hand hoe (2) Ox plough (3) Other …………………

2.8 (a)In the past 12 months did your household sell any rice YES/ NO?
(b) If YES, how many bags?…………..
c) How many bags would sell in a good year ?…………
(d) How many bags would you sell in a bad year?…………….

3. **Land**

3.1 What is the total area of land available to you for farming ?………….acres
3.2 What is the total area of land available to the household to which you belong for farming?…………acres
3.3 How many separate plots of land do you have available to you for farming (including land under fallow)?………
3.4 Please provide the following information about each plot

No.	How land was acquired +	Year in which land was acquired	Location or type of shamba^	Distance from h'-stead Minutes walking	Area acres	Soil type-farmer class-ification	Suitable for Rice *	If NOT suitable for rice explain why not	Suitable for which other crops **	Land use last season **	Last time green manure was applied	Last time animal manure was applied	Last time chemical fertilizer was applied	**STRIGA*** **
1														

+ How land acquired; VG =village govt; I= Inherited; P =Purchased; B =borrowed; R = rented; G =Gift; Co= Communual; O = Other.
^ Eg Matombo division: Hilly/ forest fields (*Mwituni*) Home gardens (*Jaladani)* Valley bottoms (*bustani*) Lower plains (*makondeni)*
* Suitable for rice: N= not suitable; S = suitable; VS = very suitable

** BE=Bean; BN= bambaranut; CA = cassava; CAB –cabbage; CO= cotton; COP= cowpea; CP =chickpea;FA = Fallow;GG = green gram; GN=g'nut; MA=maize; PM = Pearl millet; RI=Rice; SF=sunflower; SO = Sorghum; SP=sweet potato; SS=simsim; OT=Other;

*** Striga: 0 =Zero/ None; L= low; H =High.

Appendix 5: Demonstration plot monitoring sheet.

Village:………………….. Farmer name………………………. Recorder……………………

For each plot:

2002/03 season crop…………………. 2003/04 season crop……………………………

For 2002/03:

1. Tillage undertaken before planting………………………………………………………………………
2. Planting date:………………………………………………………
3. Weeding dates: First weeding:……. ……. Second weeding………………….. Third weeding………………

FOR RICE PLOTS ONLY

4. Number of *Striga* shoots in 5m x 5 m area when rice is flowering……………………………
5. Kgs of rice harvested from a 5 m x 5 m area in the plot.

FOR PIGEON PEA PLOTS

6. Kgs of pigeon pea seed harvested from a 5 m x 5 m area in the plot

For 2003/04:

FOR RICE PLOTS PLANTED AFTER *CROTALARIA* or "Kiraka" (Matombo only)

1. Date of incorporation of *Crotalaria* or kiraka………………………………………………
1. Method of incorporation: As whole plants or chopped………………….With hoe or plough……………………

FOR ALL RICE PLOTS (following rice, Crotalaria or pigeon pea)

2. Rice Planting date…………………………………………..
6. Rice Weeding dates: First weeding:……. ……. Second weeding………………….. Third weeding………………
7. Number of *Striga* shoots in 5m x 5 m area when rice is flowering……………………………
8. Kgs of rice harvested from a 5 m x 5 m area in the plot………………………………………

Appendix 6
MRADI WA KURUTUBISHA UDONGO KWENYE MASHAMBA YA MPUNGA YALIYOATHIRIKA NA VIDUHA (ZA0511/R8191)

Kijiji……………..Mkulima…………………………
Mchukua takwimu………………………………..….

KARATASI YA KUCHUKUA TAKWIMU MUHIMU

Mpangilio wa Vipando:

Msimu wa kwaqnza..Mwaka ..200…

Majerea 1		Mbaazi 2		Mpunga 3	

Takwimu za kuchukua:

Plot ya Mpunga	Tarehe ya kupanda mpunga	
	Tarehe ya palizi ya kwanza	
	Tarehe ya palizi ya pili	
	Tarehe ya palizi ya tatu	
	Idadi ya viduha eneo la 5m x 5m	
	Mavuno ya mpunga eneo la 5m x 5m (kg)	
Plot ya Mbaazi	Imepigwa dawa mara ngapi	
	Mavuno ya mbaazi eneo la 5m x 5m (kg)	
Plot za marejea	Tarehe ya kupanda……	

Tarehe ya kufukia marejea--------------------------------
Njia iliyotumika kufukia marejea-

A) mimea mizima au imekatwakatwa

B) Kutumia jembe la mkono
C) Tractor

Tia tick iliyokuhusu

Msimu wa pili…200………

Mpangilio wa upandaji

Mpunga 1		Mpunga 2		Mpunga 3	

Takwimu za kuchukua:

Plot 1	Idadi ya viduha eneo la 5m x 5m Wakatimpunga unachanua (12WAP)	
	Idadi ya palizi	
	Mavuno ya mpunga eneo la 5m x 5m (kg)	
Plot 2	Idadi ya viduha eneo la 5m x 5m, wakati mpunga unachanua (12WAP)	
	Idadi ya palizi	
	Mavuno ya mpunga eneo la 5m x 5m (kg)	
Plot 3	Idadi ya viduha eneo la 5m x 5m, wakati mpunga unachanua (12WAP)	
	Idadi ya palize	
	Mavuno ya mpunga	

12WP = Wiki 12 baada ya kupanda mpunga

Tarehe za kupalili mpunga

Palizi yakwanza---
Palizi ya pili---
Palizi ya tatu--

Idadi ya watu
Waliofika kuulizia na kutaka ushauri---------------
Walioomba mbegu za marejea---------------------

Matatizo uliyo yaona na ushauri wako.

Matatizo

ENHANCING PRODUCTIVITY OF UPLAND RICE ON STRIGA INFESTED SOILS PROJECT

Context Analysis
For four villages in Kyela and two villages in Matombo-Morogoro Rural Districts

Project Working Paper No. 2

Prepared by
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Preface

Striga species, the so-called witchweed, are widespread on the fields of small holder farmers in semi-arid areas of Eastern and Southern Africa. These noxious parasitic weeds principally attack and reduce the yield of finger millet, maize, sorghum and upland rice in these regions. In many areas it is the crops of resource-poor households that are affected by these weeds. In Tanzania upland rice is attacked by *S. asiatica* in a number of areas. Since 1996 staff from Ilonga Agricultural Research Institute and Sokoine University in Tanzania, and Natural Resources Institute in UK have been collaborating with district agricultural extension in studies aimed at developing integrated *Striga* management practices for the rice crop. Studies have been undertaken with two groups of rice farmers in Kyela District located in the Southern Highlands agricultural zone. Through on-farm trials the farmers came to appreciate that *Striga* infestation and poor rice production are associated with and indicators of low soil fertility. This in turn is a consequence of continuous rice cultivation in the absence of using any fertilizer or manure. While the trials demonstrated that up to a 60% reduction in *Striga* numbers and a 40% increase in rice yield could be achieved by using urea fertilizer farmers decided they did not wish to invest scarce cash in fertilizer. Instead they became interested in the opportunity, also observed from trials, to improve rice productivity on infested soils by introducing the green manure crop *Crotalaria*.

The current project "On-farm verification and promotion of green manure for enhancing upland rice productivity on *Striga* infested fields in Tanzania", operating from October 2002 to March 2005, aims to scale up the demonstration of using the green manure in rotation with rice in both Kyela (Mbeya Region) and Matambo (Morogoro Region).

The purpose of this report is to present the findings from the context analysis conducted in four villages of Kyela and two villages in Matombo-Morogoro rural districts. This was to assist farmers understand their situation they are living in and to set strategies to alleviate the situation.

Further information on the project or further copies of this report are obtainable from:

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Cover Page:
Farmers interracting together before visiting the demonstration plots Kilasilo-Kyela

Acknowledgement
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EXCUTIVE SUMMARY

This report contributes to out put 2 of project R8194 namely; *On-farm verification and promotion of green manure for enhancing upland rice productivity on Striga infested fields*. It reports specifically on activity 2.1 identification of information needs for different stakeholders and 2.2 design of information strategies for different stakeholders.

Objectives:

The main objectives of the community context analysis were

- ► Analyze the situation in which farmers live and synthesize this information so That the participants have common understanding of their real situation.
- ► Collect baseline data to enable future evaluation of the project
- ► Plan for the future to improve livelihoods
- ► Develop a common understanding of the proposed green manure project.

Six separate villages, four in Kyela and two in Matombo-Morogoro rural district workshops were held in February 2003.

Key political Issues were

Establishment of a multiparty system
Strengthening leadership to village level (Vitongoji)
Party activities have been separated from those of the government
Farmers and extension staff do not know most of the policy issues
The number of women taking leadership is negligible

Key economic issues:

Rice yields and maize (in Matombo) have declined from 20 bags to 1-2 bags per acre respectively
Free market economy
Removal of control posts within and outside the country
High input prices and low prices of agricultural produce
Land scarcity due to population pressure
Average land per household was estimated to be 2 acres
Limited marketing opportunities, dominated by middlemen, who offer very low prices

Key social and traditional issues were

High incidence of rice theft
Collective farming among social groups is no longer being practiced
Rice is used as food during celebrations

Key environmental issues were

Decline in soil fertility
Increase of *Striga and Ramphicarpa (Kyela)* problem
Drought and poor rainfall distribution during the season
Serious deforestation
Rivers have dried out
Wild animals have disappeared but in some villages destructive animals have increased-monkeys

1.0 Introduction

The context analysis was carried out in four villages in Kyela district and two villages in Matombo division that are participating in *Crotalaria* promotion project. The objective was to assist farmers understand their situation so that they can fully understand the challenge ahead of them and set strategies to alleviate the situation.

When and where:

25th – 28th January 2003 in four villages of Kyela

31st to 1st February 2003 in two villages of Matombo

Facilitators: Mr Patrick Lameck in collaboration with Dr A Mbwaga, Dr. G. Ley, Mr Kayeke and extension workers from the district council team

General objective

To carry out a context analysis of 4 villages in Kyela District and 2 villages in Matombo –Morogoro Rural District in order to assist farmers, ARI Ilonga and other stakeholders so that they can consolidate their efforts to improve rice production in the project area.

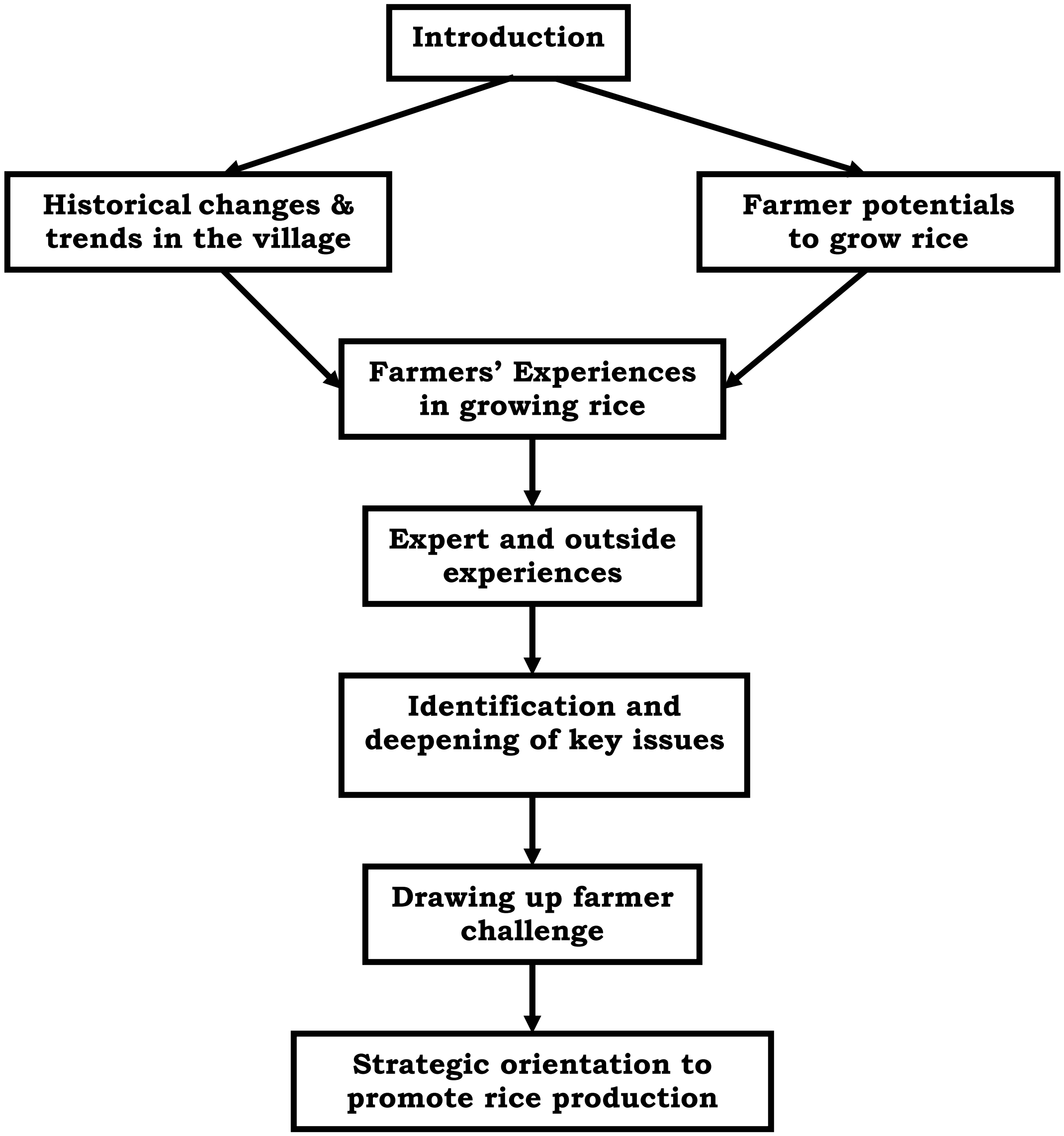
Specific objectives

- To identify with farmers (participating in *Striga* research) the real situation of the villages where they live.
- To enable farmers develop ownership of the research project.
- To expose to the farmers the real situation under which they are operating and which is usually not visualized by them.
- To have baseline data that can be used to evaluate the research programme to improve rice production.

Participants

Farmer research groups, Extension officers, Village government leaders, Researchers

Workshop process



2.0 Context analysis of target villages

For increased participation, cards to introduce individual participants were used. Participants included research group members, village leaders, extension workers and interested farmers

2.1 Kilasilo Village in Kyela District, Mbeya Region

Farmers have participated in research on Striga management in rice in Kilasilo since 1997. A strong farmer research group has developed, which has undertaken on-farm trials to observe the effect of using urea fertilizer on rice productivity on Striga infested fields. The first plots of Crotalaria were planted here in 2001. At the time of context analysis the group consisted of 7 women and 15 men.

2.1.1. Historical changes/Trends in relation to rice production in the target villages

a). Political;

- Multiparty system has improved democracy and freedom of expression of farmers and other stakeholders such as NGOs, institutions etc.
  Village councils have responsibilities adhered to and supported constitutionally, have been given more power by the central government through local government such as Village register book for village land ownership.
- Village government institutional capacity building by introduction of sub village (quarters) leadership for improved communication.
- Due to their low participation, women are encouraged to contest for the village government leaderships. This is happening slowly.
- National policies are still not known by villagers, leaders and some experts.

b). Economic situation:

- It is a state of free market economy,
- Rice is the major food and cash crop in the village.
- Prices are not stable and not attractive for farmers
- There is no market information among rural communities.
- There are fake agricultural inputs on the markets.
- Cross border trade is allowed
- Rice is a food and cash crop, but production is falling down year after year
- Higher prices of agricultural inputs; for example the current price of important inputs like Fertilizer (i). DAP 18000Tsh per 50kg bag enough for one acre, (ii). Urea 16000Tsh per 50kg bags enough for one acre, (iii) herbicide 2,4-D 1l for ¾ of an acre sold at 6000Ths per litre. However the production of rice is 1-2 bags per acre and sells at 12000 Tshs. to 18000 Tshs per bag. Hence cost of production cannot be justified; as result farmers do not buy agriculture inputs. Some years ago when the environment was good, one acre could produce up to 10 bags of rice per acre.
- The land under cultivation is not enough due to over population so the only option is to increase output per unit area.

- About 40% of the households have cattle, 2-3 heads per house hold and grazing is communal. However number of cattle was said to be increasing at a small rate and are mainly for providing draft power.

c). Cultural value of rice

- Rice is a special food during festivals, dowry paying and ceremony. Land is distributed to older sons in a family.
- There is a slow trend of distributing land to daughters.

d). Social changes

- Farmers do invite others to assist in joint land cultivation.
- There is a limited extension services in the village. The existing extension officer covers more than one village. This is too large area for him to be efficient.
- There were IFAD services on savings and credits for the past two years in the village but they didn't help farmers to solve their rice-related problems. Farmers had to repay the credits at harvest time when the price of rice was still very low.

e). Environmental changes:

- Increased plant pest *Striga* in upland rice and *Ramphicarpa fistulosa* in lowland rice. These have reduced to the great extent rice production in the last 10 years.
- Increased abundance of insect pests and diseases (e.g. Rice Yellow Mottle Virus).
- There is serious fertility depletion in farmer fields for rice production as a, result farmers have decided to change crops; increased growing of cassava as an alternative but not preferred crop
- There is a problem of weed infestation and emergence of new weeds (Minyaru) and destructive birds as a problem in rice.
- Rains are not reliable and unevenly distributed.
- Cutting of trees and bush clearing has caused wild animals to disappear from the village, as they prefer relatively thick bushes.

f). Gender-

Activity in rice production	**Done by**	
	Men	**Women**
Land preparation and cultivation	X	
Planting	X	X
Weeding	X	X
Harvesting	X	X
Who owns the produce	X	

Men own the rice enterprise and in case of divorce the woman is left without anything. This has an impact on rice production such as

- Stealing of grain from the store by women and it may happen also to men
- Women do not put effort to increase rice production and do not bother even to train children on rice production. Women are known to be good teachers of the family.
- Dividing plots between husband and a wife to ensure proper use of produce at the household level. Although husbands take a lion share of the plots and the produce their expenditure is unknown to family issues. Income from women's plots takes care of domestic and children issues.

2.1.2 Farmer Potentials to Grow Rice;

a). Strength

These include things that farmers have at their disposal and are making use in rice production. These are;

- Land is available but not considered to be sufficient
- Farmers have oxen and ox-ploughs and there still some farmers use hand hoe for cultivation.
- Human power (healthier - question of reduced manpower due to HIV) and indigenous knowledge.
- Experiences from fore fathers and from other sources
- Local and traditional varieties of rice.

b). Opportunities

In this context these are resources that are at farmer's disposal but farmers are not using them (for reasons best known to themselves) and they posses the capacity to use them.

- Animal manure is available in limited quantities but not used.
- *Crotalaria* is also available.
- The knowledge of *Striga* and *Ramphicarpa* is available to farmers who have already participated in a farmer research group.
- Some farmers are participating in *Crotalaria* Research
- District Agriculture office is available to offer extension services.
- Village government support rice production
- Farmers are free to seek and choose the market that gives them better prices.
- Kyela Rice is of high quality and is highly preferred by consumers nationally.

c). Weaknesses;

These are limitations that farmers can solve but they are not willing to do so for reasons best known to them selves. These include;

- Farmers ignore better agricultural practices and technologies, which they have been taught since colonial era.
- Farmers do not look for market information
- Farmers do not take, keep and make use of data from their actions.
- They don't look for agriculture information on rice production at various sources such as District Council.
- There is mistrust within the family resulting in misuse of income from rice produce.

d). Threats

These are natural calamities that are beyond farmer's control. They are at the back of farmer's minds because they increase risk in farming. These include;

- Unreliable, unpredictable and unevenly distributed rains.
- Existence of parasitic plant *Striga* with threatening characteristics of a high rate of seeding and seed viability up to 20 years.
- *Quelea quelea*, insect pests and diseases outbreaks

2.1.3 Farmers' experiences in growing rice

a). Achievements from rice production

Part of income from rice production has contributed for farmers to buy cows, bicycles, clothes, pay for school education up to form IV (Secondary education) and to buy agricultural inputs. They sometimes use this income for dowry, and capital for petty business. Rice also ensures household food security and good relationship with neighbours who are invited for collective meals.

b). Problems facing farmers in rice production

- There are few Extension officers
- Low market price for rice accompanied by high production costs.
- There are outbreaks of birds, diseases and pests
- Prices of agric inputs are high so profits are very low
- Agricultural input stockists sell fake products (e.g. herbicides and fertilizers)
- The fields are infested with parasitic weeds-*Striga* and *Ramphicarpa*
- There is poor or no record keeping
- Depleted soil fertility
- Limited land for cultivation
- Very low rice yields
- There is no source for improved seed

c). How farmers have solved the problems

- They have formed research groups to investigate on agriculture related problems including those of *Striga* and other rice weeds.
- Calling extension officers from the district councils for assistance.

- Farmer to farmer learning. Farmers share and exchange experiences among them selves.
- Look for market information only at village level.
- To use available agricultural services and make use of indigenous knowledge and available technologies.
- To conduct research, collect results and keep record for evaluation
- Look for agricultural information
- Grow *Crotalaria* and use animal manure to improve soil fertility to increase rice productivity

2.1.4 Experts and outside experiences

Training on Striga has been conducted in the village as well as trials on Striga control options. Farmers were advised to;

- be creative, and learn from research conducted
- utilise the opportunity of having researchers in the village
- Use the knowledge acquired on Striga control.
- Women are encouraged to participate in research activities and make contribution at workshops
- form and enforce bye-laws in collaboration with village government to improve rice production

2.1.5 Identification and deepening of Key issues.

From the workshop analysis findings were analysed and summarised into the following key issues and root causes were brainstormed thus:
Before this analysis

1. Farmers did not know the real situation of their village that affected their rice production.
2. Farmers' did not know that *Striga* and *Ramphicarpa* infestations have reduced upland rice production from 10 to 2 bags of rice per acre.
3. The farmers, who are members of the farmer research group were not keen on doing their experiments on their own but depended on data collected by the group secretary and explanation made by their chairman.

From this analysis all farmers agreed start to focus on and developed the following challenge:

Farmers of Kilasilo village want to improve rice production from 2 to 10 bags/acre, while conserving the environment by complete eradication of Striga and Ramphicarpa at lowest costs by using locally available resources through research.

2.1.6 Strategies:

From the three identified key issues, farmer drew up the following strategies (see the table bellow);

Key issues no.	What to be done	How to be done	By whom	When
1	Educate other farmers	By teaching at any gathering (formal/informal)	All this workshop participants	From 25th January 2003
2.	Create a habit of keeping records	Everyone must buy a pen and a copy book	All this workshop participants	From 25th January 2003
3.	Farmers should understand and be ready to explain what he/she is doing in Striga research	Those who don't know they must learn from others immediately	Those who don't know	By 28th February, 2003

2.1.7 Institutional analysis:

2.1.7.1 List of stakeholders working in the area

Found within the village	Found outside the village
I. Primary cooperative Ikolo. II. Village government III. Primary school IV. Churches V. Dispensaries VI. Middlemen	I. Outside middlemen such as Mohamed Enterprises Fride Husein etc. II. Village extension worker VEW. III. ARI Uyole IV. ARI Ilonga V. KYERUCU District Cooperative union VI. Sokoine University of Agriculture (SUA). VII. Kikusya rice seed research VIII. District Council (DALDOs Office) IX. Police station Boda Primary court Busale X. Mosque Boda.

2.1.7.2 Services rendered by these institutions:

I. Primary co-operative Ikolo; *Buys rice and cashew nuts*
II. Village government; *Rule and governs the village*
III. Churches; *Provide spiritual services*
IV. Dispensaries; *Provide cure, prevention and education on health services*
V. Middlemen; *Buy farmer's produce but at a very low price*
VI. Outside middlemen such as Mohamed Enterprises, Fride Husein etc; *Buy farmer's produce at a very low price*

VII. Village agricultural extension officer: *Provide agric. extension services and advisory*

VIII. ARI Uyole; *Sensitise farmers on use of industrial and burnt rice husks fertilizers*

IX. ARI Ilonga; *Facilitate farmers to conduct research on improvement of soil fertility and control of striga*

X. KYERUCU (District Co-operative union); Sells agriculture inputs on loan and buys farmer's agricultural produce

XI. Sokoine University of Agriculture (SUA). *Conducted one farmer study tour to Mbarali and Mandibila .irrigation sites*

XII. Kikusya rice trial site: *Screens and evaluates rice varieties and conduct other agronomic trials on rice*

XIII. District Council (DALDOs Office) *Offers agricultural advisory services & coordinate all agricultural activities*

XIV. Police station at Boda: *Ensure peace by enforcing laws and regulations*

XV. Primary court at Busale: *Provide rights to farmers*

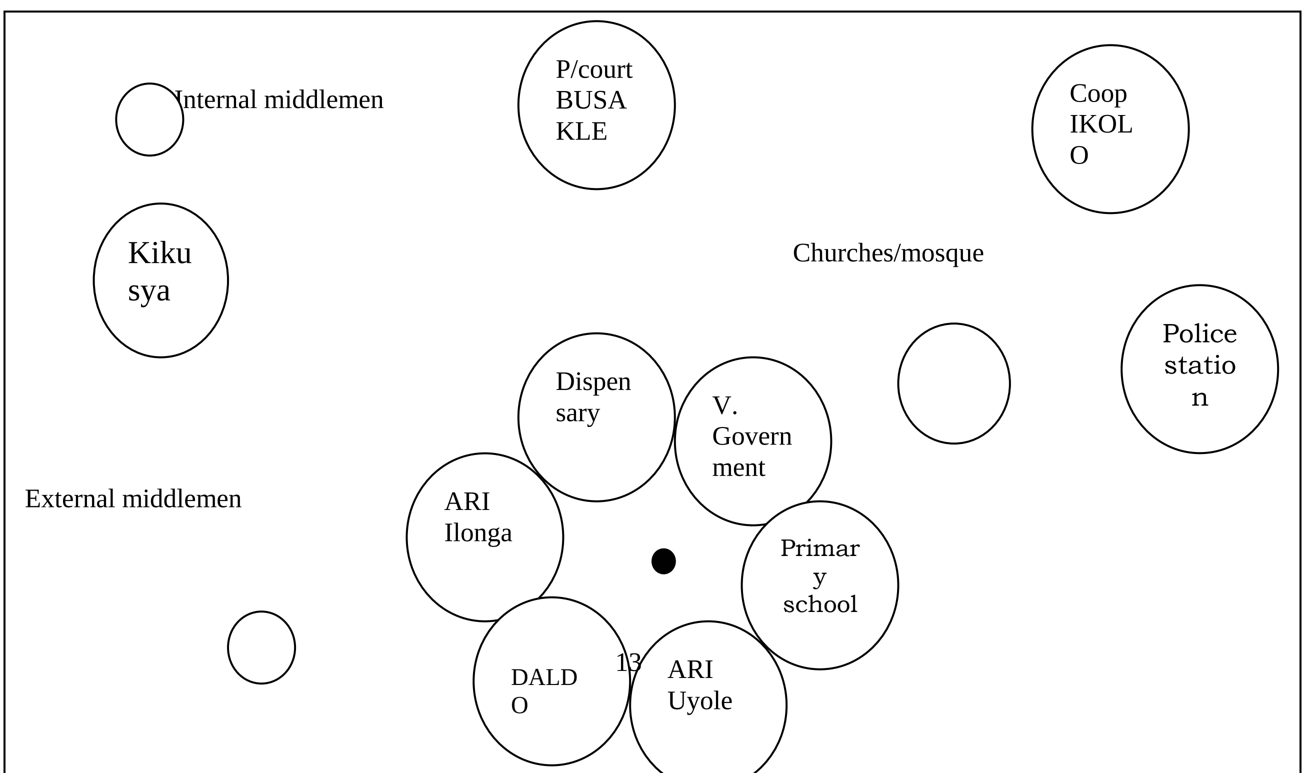
XVI. Mosque at Boda: *Provide spiritual services*

2.1.7.3 Analysis of the Stake holders

In this exercise farmers gathered together to analyse all the institutions mentioned above. Venn diagram was used for analysis, where circles indicated institutions.

- Big circles showed institutions that are most important to the farmer researcher groups.
- Middle sized circles showed those institutions that are of average importance to them.
- The small circles showed that the institutions were of less importance to the group.
- The Black dot at the centre formed the centre of the farmer research group. If an institution has close relation ship with the farmer researcher group was placed closer to the centre and then the distance increased from the centre with decrease in relationship. The poorest relationship was placed very far away from the centre of the research group.

2.1.7.4 The Venn diagram developed by Kibalu Farmer Research Group.



Form the Venn diagram;

- Those institutions found very far have poor relation ship with the farmer researcher group. For example they see SUA vehicles working with farmers, but they are not aware of what they are dealing with that is why farmers had poor or no relation ship with farmers.
- External middlemen are of poor importance to the researcher farmer group (given smaller circle) since they offer poor prices and have poor relationship as they see them coming to buy their crop at a very low prices and provides no marketing information hence exploit them(Placed very far from the farmer group).
- ARI Ilonga is very important to these farmers (Bigger circle) as it facilitates them to research on striga eradication and soil fertility improvement for their improved livelihood. The see them coming most frequent and they appreciate what they are doing (Placed closer to the farmer group).
- Kikusya trial site (located 12 km from the farmer research group) was found to be very important to these farmers (Bigger circle) because they need improved rice seed, but farmers were not aware of what the centre was doing.

2.2 Itope Village in Kyela District, Mbeya Region

Farmer participation in research on management of Striga began in Itope in 1998. On-farm trials on use of urea have been undertaken in this village. At the time of this context analysis the farmer research group in the village consisted of 9 men 3 women.

The context analysis was undertaken with one group of men and women working using cards, brain storming and deepening discussions.

2.2.1 Historical changes

a). Political –

b) Multiparty system has improved democracy and freedom of expression by farmers and other stakeholders such as NGOs, institutions etc.

- Public services are no longer free, due to the introduction of cost sharing. Trend is for farmers to bear all public services at costs.
- Village government institutional capacity building by reinforcing sub village (quarters) leadership for improved communication.
- There is low participation of women in the village government leadership
- National policies are not known by villagers, leaders and some experts.
- Splitting of ruling party leadership from government leadership has led to minimise interference in local government for roles and responsibilities. There is a Village government chairman and party Village Chairman for the ruling party to deal with mainly political issues.

b). Economic situation

Rice is the major food and cash crop in the village. However the following economic situations were identified

- Free market economy,
- Prices are not stable, there is no marketing point, which is not good for farmers
- There are number of middlemen, who set buying prices
- There is no market information among rural communities.
- There are fake agriculture inputs on the markets.
- Cross border trade in Malawi is allowed
- Rice is a food and cash crop, but production is falling season after season, cassava is replacing rice.
- Higher prices of agricultural in put; for example the current price of following input like fertilizer (i). DAP 18000Tsh per 50kg bag enough for one acre, (ii). Urea 16000Tsh per 50kg bag enough for one, (iii) herbicide 2,4D 1l for ¾ of an acre sold at 6000Ths per litre. But the production of rice is 1-2 bags per acre and sells at 12000 Tshs. per bag to 18000 Tshs. Cost of production cannot be justified so farmers do not buy agriculture inputs. In the past when the environment was good one acre of rice could produce up to 10 bags of rice. However today rice production has decreased by 80%.
- The land under cultivation is insufficient due to over population; an option is to increase output per unit area.
- About 40% of the households have cattle, 2-3 heads per house-hold and grazing is communal.
- About 50% of the households cultivate their rice fields using ox-plough

c). Cultural value of rice

Rice is the special food during festivals and dowry paying ceremonies.

d). Social changes

- Farmers do invite others to assist in fieldwork like cultivation, weeding and harvesting, but the spirit of working together is lessening due to the reduced yields obtained.
- Limited extension services in agriculture especially for crop production.
- An IFAD project provided loans for agriculture inputs to farmers. Because farmers had to pay back the loan immediately after harvest when the prices of rice are, few were interested to use the loans.
- There is a lot of rice theft in the village due to scarcity of the crop.

e). Environmental changes

- Rains are very unreliable. There is increased incidence today of floods and drought.

- Insect pests and diseases are increasing.
- There is fertility depletion in farmers' fields and increase in *Striga*
- Livestock keeping has increased but number of heads per household has decreased
- Cutting trees and bush clearing for farm and houses has caused wild animals to move far away from the village

f). Gender

No	Activity in rice production	Done by	
		Men	women
1	Land preparation and cultivation	X	-
2	Planting	X	X
3	Weeding	X	-
4	Harvesting	X	X
5	Who owns the produce	X	-

2.2.2 Farmer Potentials to Grow Rice

a). Strength

- There are ox-ploughs and hand hoes, some households make use of hired labour
- Seeds of local rice varieties are collected from previous harvest and used as seed.
- Manpower (muscle power)
- Experiences from forefathers and other sources.
- Indigenous knowledge and technologies are available

d). Opportunities

That are available at farmers disposal but are not used

- Animal manure.
- Extension officers (consultation is made on livestock only and none for crops).
- Researchers who conduct trials in their villages.
- There is a research station field at Kikusya in a nearby village conducting trials on rice varieties. None of the farmers was aware of what is being researched there.
- Market information is available through radio, various leaflets and newsletters.
- There is a Farmers Research Group in the village.
- Kyela Rice is of high quality
- Village government and District authorities support rice production

c). Weaknesses

- Late land preparation and cultivation that delays following activities.
- Ignoring better agricultural practices they have learned since colonial times such as deep tillage, contours etc.
- Lack of searching for agriculture and marketing information on rice.
- There is mistrust within the family to misuse the little income they get from rice production.

d). Threats.

- Unreliable and unpredictable rains.
- Frequent floods
- High rate of seeding and long seed viability of *Striga* is making it difficult to eradicate, farmers rotate with crops like cassava for severe infested soils.
- *Quelea quelea*, insect pests

2.2.3 Farmers experiences

a) Achievements

Rice production has enabled farmers to buy cows bicycles, clothes, and pay for education up to secondary school level in government schools. Farmers also buy agricultural inputs from selling rice. They sometime use it for paying dowry and building better houses. Rice also ensures household food security and good relationship with neighbours.

b). Problems facing farmers and how they solved them

- Weed problem is increasing. Solution has been hand weeding up to 3 times per season. Some few farmers from the project make use of *Crotalaria* to reduce the weed pressure in following rice crop.
- There are few Extension officers
- Poor market prices. Middlemen use this opportunity to set low prices at farm level.
- Outbreaks of birds, diseases and pests. Farmers have been setting traps, use chemicals and indigenous knowledge such as medicinal plants
- Prices of agric inputs are high. Making use of locally available resources such as hand hoe, local seeds and medicinal plants
- The fields infested with *Striga* are increasing. Formed research groups to conduct trials and at the end of the day make use of results.
- There is poor or no record keeping. Farmers need to use Research findings and keep records
- Poor soil fertility. Farmers have been doing nothing

2.2.4 Researchers' experiences

Training on Striga has been conducted in the village and control measures described. Farmers were advised to;

(ii) Be creative, and learn from research conducted in the village.
(iii) Not to despair because it looks like that farmers have despaired to improve the reduced rice production.
(iv) make use the S*triga* knowledge they have learned.

2.2.5 Identification and deepening of Key issues

From the workshop analysis of the situation above, findings were analysed and summarised into the following key issues.

1. Farmers did not know the real situation of their village that affected rice production.
2. Before this analysis farmers' did not know that upland rice production has been reduced by *Striga* infestations from 10 to 2 bags per acre.
3. Farmers who are members of Farmer Research Group were not keen in carrying out their research work thus depending much on data collected by the group secretary and explanation made by their secretary.

From this all participating farmers agreed to start awakening and developed the following challenge:

***Farmers of Itope village want to improve rice production from 3 to 20 bags per acre while improving soil fertility by complete eradication of Striga at lowest possible costs by using locally available resources through research*.**

2.2.6 Strategies

Key Issue no.	What to be done	How will it be done	By whom	When
1	Train and sensitise all other farmers	Making use of formal and informal villagers gathering	All this workshop participants	From 26th January 2003
2.	Farmers to collect keep and use records after analysis	Everyone must buy a pen and a copy book	All this workshop participants	From 26th January 2003
3.	Every farmer must understand and be ready to explain what he/she I doing in their research	Those who don't understand to learn from those who understood.	Those who don't understand	By 26th February, 2003

2.2.7.0 Institutional analysis

The farmer researcher group is called **Kilambo,** and Institutions working/available in the area are listed below.

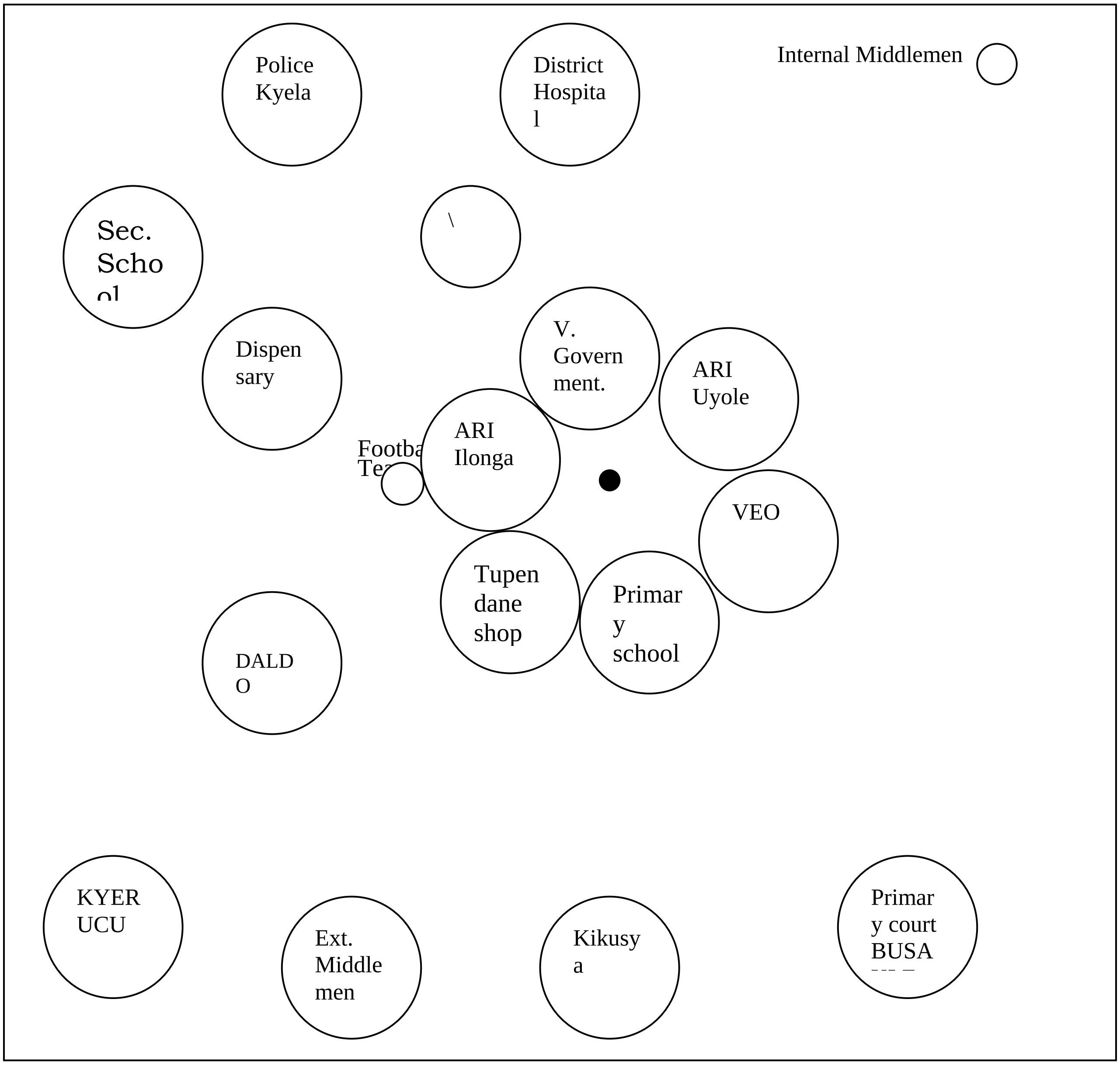
2.2.7.1 List of institutions working in the area

Found within the village	Found outside the village
I. Village government II. Churches III. Primary school Itope IV. Secondary school Itope V. Dispensaries VI. Football team VII. Pombe shop Tupendane VIII. Internal middlemen	I. District Hospital II. Police station Kyela III. Primary court Busale IV. Village extension worker VEW. V. District Council (DALDOs Office) VI. Kikusya rice seed research VII. ARI Ilonga VIII. ARI Uyole IX. Outside middlemen such as , Norman, Bionet Frida Hussein X. KYERUCU District Cooperative union

2.2.7.2 The services rendered by these institutions:

I. Village government; *Rule and governance*
II. Churches; *Provide spiritual services*
III. Primary School Itope; *Provide primary school education to their children.*
IV. Secondary school Itope; *Provide secondary school education to their children.*
V. Dispensaries; *Provide cure, prevention and education on health services*
VI. Football team; *Recreation and physical exercise for youth*
VII. Pombe shop turpentine; *Taking local brew, selling and buying small commodities*
VIII. Internal middlemen; *Buy farmer's produce at a very low price*
IX. District Hospital Kyela; *Provide cure, prevention and education on health services*
X. Police station Kyela; *Ensure peace by enforcing laws and regulations*
XI. Primary court Busale; *Provide rights to farmers*
XII. Village agricultural extension officer (VEO). *Provide agric extension advisory service*
XIII. District Council (DALDOs Office); *Offers agricultural advisory services & coordinate all agriculture activities*
XIV. Kikusya rice trial site: *Screens rice varieties and conduct evaluation and agronomic trials.*
XV. ARI Ilonga; *Facilitate farmer to conduct research on improve soil fertility and hence eradicate striga*
XVI. ARI Uyole; *Sensitise farmer on the use of industrial and burn rice husks fertilizers*
XVII. Outside middlemen such as Mohamed Enterprises, Fride Husein etc. *Buy farmers agricultural produce.*
XVIII. KYERUCU District Cooperative union; *Sells agriculture inputs on loan and buys farmers crop produce.*

2.2.7.3 The Venn diagram developed by Itope researcher farmer group.



2.3 Konjula Village in Kyela District, Mbeya Region.

A group is being formed here to conduct Striga control demonstration plots for the first time. The group composition is 11 men and one woman.

2.3 1 Historical changes

a). Political

- Multiparty system; this has improved democracy and freedom of expression among farmers.

- Public services are no longer free.
- More emphasis has been to sub village leadership to improve village communication.
- There is low participation of women in the village government leadership despite of being encouraged.
- Development policies are still not known by villagers and most experts.
- Separating government role and responsibilities from those of the ruling party e.g. Previous the village chairman was holding two posts as the village government chairperson and Village political party Chairperson. Now there are two Chairpersons one for the government and the other for the ruling party.

b). Economic Situation.

- Free market economy from controlled market system,
- Co-operative unions are diminishing.
- Rice prices are going down year after year
- Higher prices of agricultural inputs yet inputs are below standard and in most cases inputs are not available at village level.
- Cross border trade is allowed
- Rice production has dropped from 20 to 3 bags per acre over the past 20 years.
- Population of the village is 465 households with an average acreage of 3 acres per household with one acre under rice production.
- 80% of the house holds own local cattle of 2 heads mostly used as animal power for land cultivation.
- Land is limited hence so it is difficult to ensure family food security.

c). Cultural Value of rice.

- Rice is the special food during festivals
- There are special dances after harvesting. Traditional Ngoma groups are invited from neighbouring villages and Malawi to cerebrate harvests
- After harvesting there are more visitors (far relatives and middlemen) because there is plenty of food in the village.
-

d) Social

- Availability of rice in a household strengthens good neighbourhoods. During lunch, neighbouring families bring food (rice) and eat together.
- Extension officers do not attend to farmer's agricultural problems.
- There is a lot of theft of rice in the village.

e). Environmental issues.

- Water depth in rivers has been reduced due to siltation
- Some people are cultivating along riverbanks

- Rains are very unreliable hence increased incidence of drought and floods.
- Insect pests and diseases are also increasing.
- There is tremendous fertility depletion in farmers' fields, which has resulted in increased *Striga* infestation.
- Livestock keeping has increase but number of herds per household has decreased
- Cutting trees and bush clearing for charcoal and firewood has increased. Wild animals are disappearing and microclimate has changed to more droughts.
- There is an increase in weed infestation in rice fields

f). Gender

No	Activity in rice production	Done by	
		Men	women
1	Land preparation and cultivation	X	-
2	Planting	X	X
3	Weeding	X	X
4	Harvesting	X	X
5	Who owns the produce	X	-

From the above table, it shows that the final product of rice becomes the property of men. This discourages women from making on effort to improve rice production.

2.3.2 Farmer Potentials to Grow Rice

a). Strength

- There are ox-ploughs and hand hoes in the village
- Seed is collected from previous harvest i.e. farmers recycle their own seed
- Muscular power is available
- Health
- Experiences in growing rice
- Indigenous knowledge and technology for growing rice is available

b). Opportunities

These are opportunities, which are available to farmers.

- Animal manure
- *Striga* knowledge
- Existing extension officers although not living in the village
- *Crotalaria* is available

- Researchers running trials in the area.
- There is a research trial site at Kikusya, nearby village where trials evaluating different varieties of rice are undertaken.
- Farmers Research Group was recently formed in the village to undertake demonstration plots
- Kyela Rice is of high quality and is in high demand else where in Tanzania and export.
- Village government and District authorities support rice production.

c). Weaknesses

- Time is wasted on leisure such as local brew and traditional dances
- Misuse of resources in the household
- Ignoring better agriculture practices learned since colonial times.
- Lack of searching for agriculture information.
- Traditional beliefs and cultures that are detrimental to rice production For example use of farmyard manure is believed to increase rice weeds and labour for weeding.

d). Threats to rice production

- Floods from rivers in the village and fields
- *Striga*
- *Quelea quelea*, insect pests and vermin's

2.3.3 Farmers experiences in growing rice

a). Achievements

Rice production has contributed farmers to buy livestock, bicycles, clothes, pay for education up to Form IV in government schools. They sometimes use it to pay dowry, and building better houses. Rice also ensures household food security and good relationship with neighbours.

b). Problems facing farmers and how they have been solving them.

- Increasing weeds of rice. Solution has been hand weeding and few farmers have used herbicides.
- *Striga* infestation
- Depletion of soil fertility. A possible solution is the use of *Crotalaria* to improve soil fertility; hence the formation of the group to try this practice on demo plots.
- Higher prices of agricultural inputs, there was no any ideas of how they have been to solving the problem.
- Low price of rice, there was no any ides of how to solve the problem.
- Unavailability of agriculture information.

2.3.4 Researchers' experiences.

Training on Striga biology and control options was conducted at all village workshops during January 2003. Further farmers were advised as follows;

- There are opportunities, which are not yet tapped; farmers are advised to start making use of them.
- Farmers are not keeping records so they should keep and make use of data of their activities.
- Farmers must be creative

2.3.5 Key issues

From the workshop analysis of the situation above, findings were analysed and summarised into the following key issues;

1. Farmers did not know the real situation of their village that affected rice production.
2. Before the context analysis farmers' were not aware that upland rice production has been reduced by *Striga* infestations from 10 to 2 bags per acre.
3. Farmers of Njugilo village have no culture of taking, keeping, analysing and make use of data from their actions. Hence, they are unable to detect changes in rice production due to different practices.

From this the farmers developed the following challenge:

Farmers of Konjula village wants to improve rice production from 3 to 20 bags/acre while conserving their environment by complete eradication of Striga and improving soil fertility through research.

2.3.6 Strategies

Key issue no.	What to be done	How to be done	By whom	When
1 2	Train all other farmers in the village	By making use of formal and informal gathering.	All this workshop participants	From 27th January 2003
3.	Collect, keep and analyse data while making use of results.	Farmers to have an exercise book, pen and a rural to record necessary data	All this workshop participants	From 27th January 2003

2.3.7.0 Institutional analysis

Institutions working/available in the area are as presented in the table below.

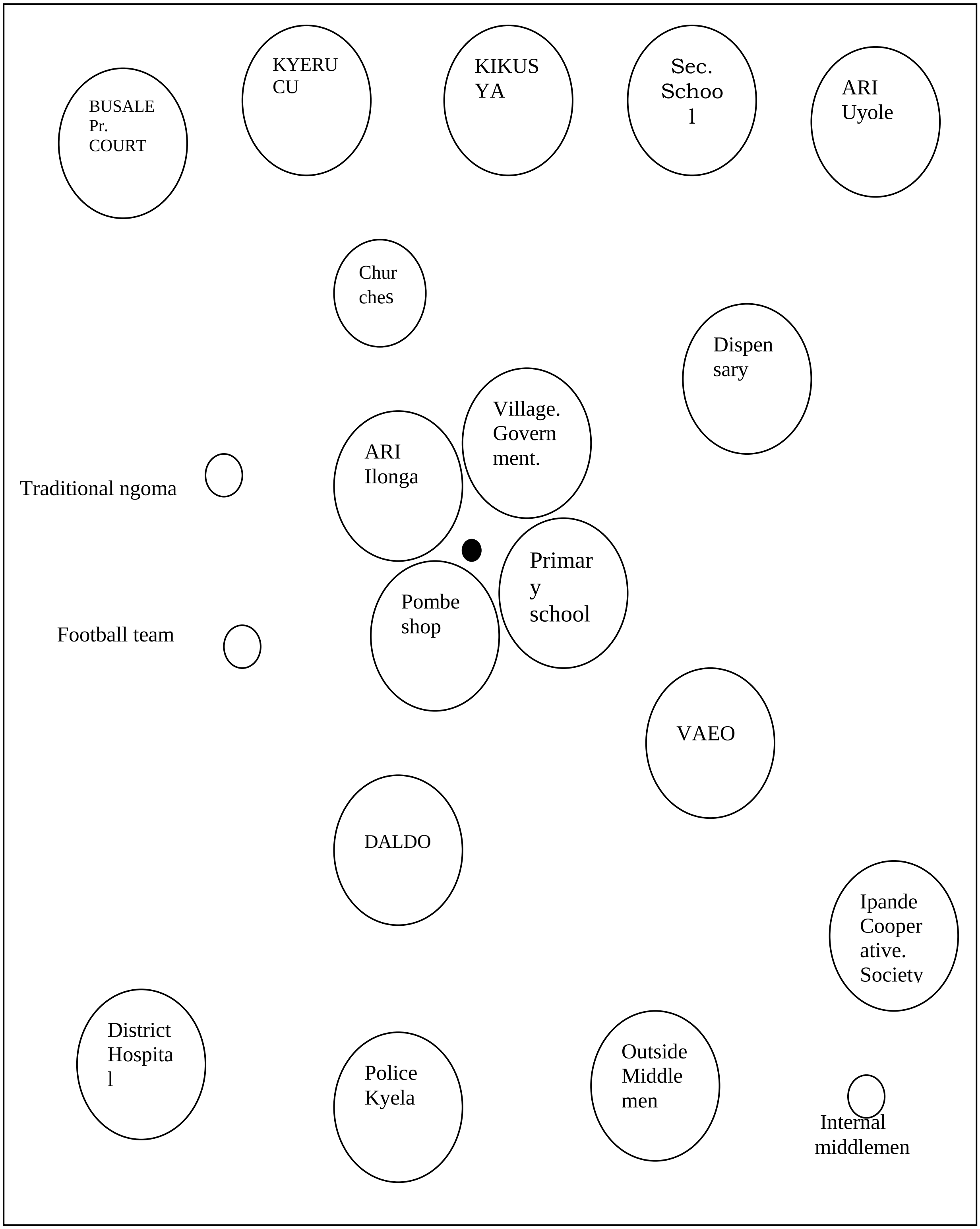
2.3.7.1 List of institutions operating in the area

Found within the village	Found outside the village
I. Churches	I. District Council (DALDOs Office)
II. Primary school Njugilo	II. KYERUCU District Cooperative union
III. Dispensaries	III. Itope Sec School.
IV. BIOLAND	IV. ARI Ilonga
V. Village government	V. Police station Kyela
VI. Ward Extension Worker WEW	VI. Primary court Busale and lusongo
VII. Traditional ngoma (Kaole and kapela)	VII. Outside middlemen such as , BIONET, Mohamed enterprises Fride Husein etc.
VIII. Football team	VIII. Kikusya rice seed research
IX. Internal middlemen	IX. District Hospital Kyela
X. Ipande Primary cooperative society	X. ARI Uyole
XI. Pombe shop Konjula	

2.3.7.2 Services rendered by these institutions:

I. Churches; *Provide spiritual services*
II. Primary school Njugilo; *Provide primary school education to children*
III. Dispensaries; *Provide cure, prevention and education on health services*
IV. BIOLAD; *Buys farmer produce at a very low price*
V. Village government; *Rule and governs the village*
VI. Ward extension worker WEW; *Provide agric extension advisory*
VII. Traditional ngoma; *For recreation and unite farmers from neighbouring villages and neighbouring country Malawi*
VIII. Football team; *Recreation and physical exercise for youth*
IX. Internal middlemen; *Buys farmer produce at a very low price*
X. Primary cooperative society Ipande;.*Buys rice and cashew nuts*
XI. Pombe shop Konjula; *Taking local brew, selling and buying small commodities*
XII. District Council (DALDOs Office); *Offers agricultural advisory services & coordinate .all agriculture activities*
XIII. *KYERUCU District Cooperative union;* Sells agriculture inputs on loan and buys farmer produced crops
XIV. Secondary school Itope; *Educate their children on secondary school education*
XV. *ARI Ilonga;* Facilitate farmer to conduct research to eradicate striga
XVI. Police station Kyela; *Ensure peace by enforcing laws and regulations*
XVII. Primary court Busale; *Provide rights to farmers*
XVIII. Outside middlemen such as Mohamed Enterprises Fride Husein etc. *Buys farmer produce at a very low price*
XIX. Kikusya rice seed research; *Screens rice seed varieties and research*
XX. District Hospital Kyela; *Provide cure, prevention and education on health services*
XXI. ARI Uyole; *Sensitise farmer on use of industrial and burn rice husks fertilizers*

2.3.7.3 The Venn diagram developed by Konjula researcher farmer group.



2.4 Sinyanga Village in Kyela District, Mbeya Region

This village joined the Striga project for the season 2002/03. The group has a total number of 12 members with 2.of them being women. Training on Striga biology and control measures was conducted in November 2002 when the Farmer Research Group was formed.

2.4.1 Historical changes

a). Political

- Multiparty system; this has improved democracy and freedom of expression
- Village leadership has been strengthened by having sub-village leaders
- There is low participation of women in the village government leadership
- The society is not aware of the national policies
- The party and government responsibilities have been separated

b). Economical situation

- Free market economy
- Prices of agricultural products have dropped
- Rice is the main food and cash crop in the village.
- Rice production has dropped from 20 to 5 bags per acre over the past 20 years.
- High prices of agricultural inputs
- The land under cultivation for each household is getting smaller due to population growth. There is an average of 2 to 5 acre per household
- In the household of 7-8 members consuming approximate 10 bags of rice per year
- About 75% of the households own an ox-plough and oxen
- The total number of households in the village is 375.
- Cross border trade is allowed with Malawi.

c). Cultural value of rice:

- Rice is the special food during festivals and is sometimes used as dowry,
- There are a number of festivals after rice harvesting
- Women are not free to use the rice in a household because the rice harvest belong the man

d). Social

- Cultivation used to be done collectively. This has now changed due to increased cost of food and poor yield of rice.

- Sales of agriculture input has been privatised, prices are higher than in the past.
- Farmers are not aware of the importance of Extension officers
- There is a lot of theft of rice in the village

g). Environmental changes.

- Rains have become very unreliable
- There are rills and gullies formed due to soil erosion
- *Striga* and other weeds are increasing
- There is fertility depletion in farmers' fields hence increase in *Striga* infestation
- Cutting trees and bush clearing for firewood, charcoal and houses have caused wild animals to move away from the village and changed the microclimate to reduced rainfall amount.
- There has been an increases in attacks on rice by birds, vermin, tortoises, occasionally army worm and long-horned grasshopper and white grabs

f). Gender responsibility-

No	Activity in rice production	Done by	
		Men	Women
1	Land preparation and cultivation	X	
2	Planting	X	X
3	Weeding	X	
4	Harvesting	X	X
5	Who owns the produce	X	-

Cultivation is done by men, weeding by women, harvesting together but the products belongs to men. At the same time female are not allowed to talk before men. The conditions are not conducive for women to promote increase in rice production.

2.4.2 Farmer Potentials to Grow Rice

a). Strength available:

- Oxen and ox-plough
- Hand hoes
- Limited land.
- Own recycled seed collected from previous harvest
- Animal manure
- Health people
- Muscular power.

b). Opportunities

Those are available at farmer's exposure

- Rivers (Can be used for vegetable irrigation)
- Animal manure
- Extension officers.
- Researchers are available
- There is a research trial site at Kikusya nearby village, conducting rice variety trials.
- Kyela Rice is in high demanded due to its aromatic taste
- Village government and District authorities support rice production

c). Weaknesses

- Delay in land preparation
- Poor practice of agriculture technologies
- Farmers don't look for agricultural information
- There is mistrust within the family

d). Threats to rice production

- Increased draught.
- Frequent floods.
- Increased infestation of the fields by *Striga.*
- Increased rice diseases.

2.4.3 Farmers experiences-success

a). Achievements

Rice production has contributed for farmers to buy cows, bicycles, clothes, paying school fees for education up to Form VI in government schools. Buy agricultural inputs. They sometime s use it for dowry, and building better houses. Rice also ensures household food security and good relationship with neighbours.

b). Problems and how they solved them

- Weed problem is increasing and is being solved by hand weeding 3 times per season
- Outbreaks of birds, diseases, weeds and pests.
- Prices of agricultural inputs are higher and no solution was suggested.
- The fields infested with *Striga* are increasing. Farmer recently formed a research group on Striga. So far solution was hand weeding.
- There is poor or no record keeping among farmers and no solution was suggested
- Poor soil fertility no solution was suggested, however recently a group was formed to start growing Crotalaria.

2.4.4 Researchers' experiences

Training on Striga control was conducted in the village in November 2002.

2.4.5 Key issues

From the workshop analysis of the situation above, findings were analysed and summarised into the following key issues;

1. Farmers did not know the real situation of their village that affected rice production.
2. Through discussion farmers' have come to know that their upland rice production has been reduced by *Striga* infestation from 20 to 5 bags of rice per acre
3. Farmers of Sinyanga village have been depending on resources from outside, which they cannot afford.
4. The farmers are working without making realistic plans and they don't keep records of their agricultural activities

From this analysis all farmers agreed to start awakening and they developed the following challenge:

***Farmers of Sinyanga village want to improve rice production from 5 to 20 bags/acre while improving soil fertility by complete eradication of Striga and improving soil fertility through research*.**

2.4.6 Strategies

Key issue no.	What to be done	How to be done	By whom	When
1	Train and sensitise other farmers	By use of formal and informal gathering	All this workshop participants	From 28th January 2003
2.	Improve rice production	Improve soil fertility by animal manure, *Crotalaria* and carry research	All this workshop participants	From 28th January 2003
3.	Farmers must change to be creative	They have to use available resources Education farmer to farmer Follow up on information	All this workshop participants	By 28th February, 2003
4	Keep records and make use of them	To buy copy books, pen and rule	All this workshop participants	From 28th January, 2003

2.4.7.0 Institutional analysis:

The farmer research group in this village is called **Uhuru** and institutions working/available in the area are as presented below

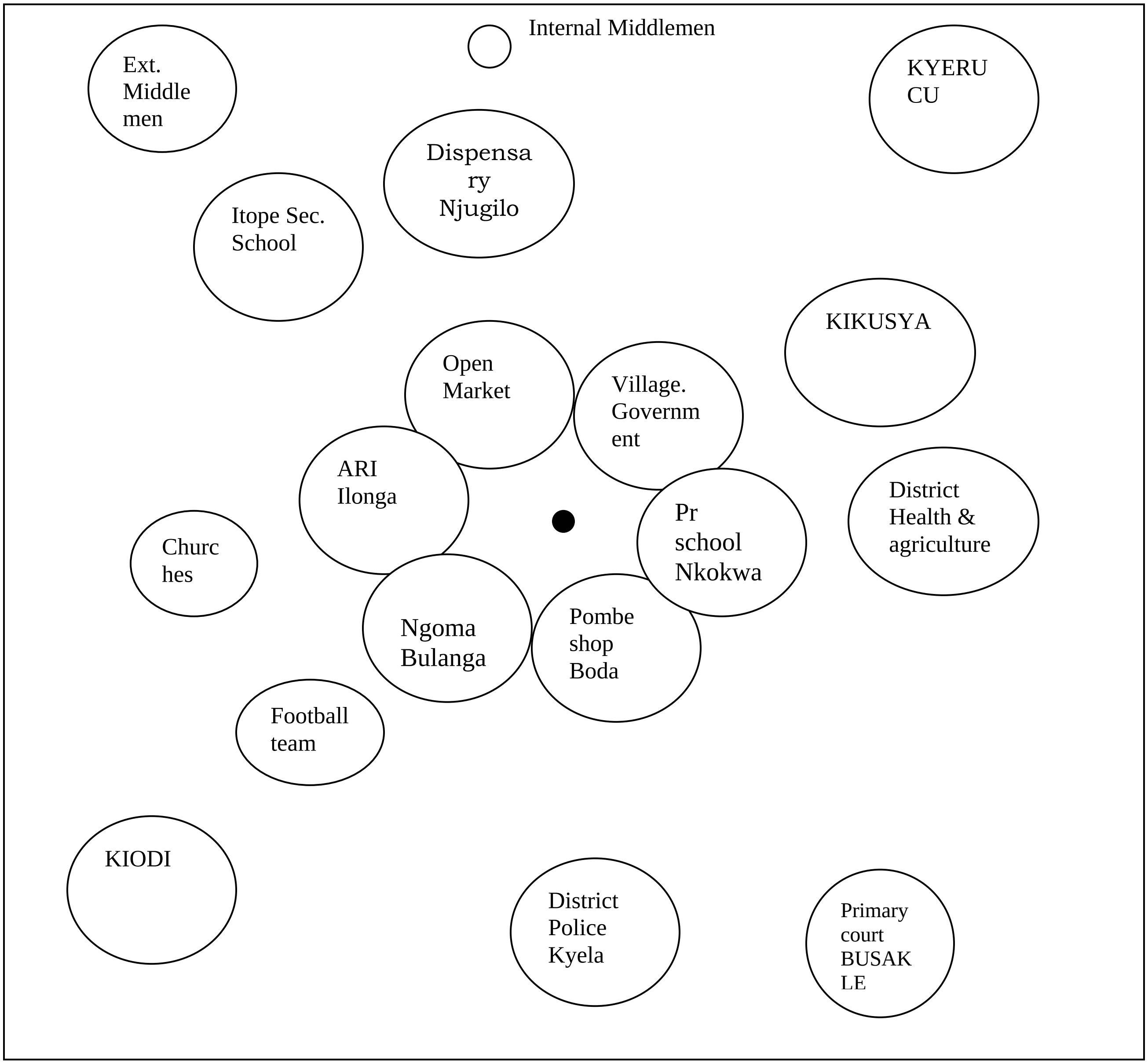
2.4.7.1 List of stakeholders working in the area

Within the village	Found outside the village
I. Primary school Nkokwa	I. Njugilo dispensary
II. Village government	II. Ward extension worker VEW. (Agriculture and .health)
III. Churches	III. Outside middlemen such as , BIOLAND, Mohamed Enterprises Fride Husein etc.
IV. Pombe shop Boda	IV. District Council (DALDOs Office)
V. Open Market Sinyanga	V. Police station Kyela
VI. Football and netball team.	VI. Primary court Busale.
VII. Traditional ngoma (Bulanga)	VII. ARI Ilonga
VIII. Middlemen	VIII. Kikusya rice seed research
	IX. Itope Sec School.
	X. KIODI saving and credit
	XI. KYERUCU District Cooperative union

2.4.7.2 What services these stakeholders provide

I. Primary school Nkokwa *Provide primary school education to children*
II. Village government *Rule and governs the village*
III. Churches; *Provide spiritual services*
IV. Pombe shop Boda; *Drinking local brew, selling and buying small commodities*
V. Open Market Sinyanga; *selling and buying small Agric inputs and farmer produce as well as household* commodities
VI. Football team; *Recreation and physical exercise for youth*
VII. Traditional ngoma Bulanga; *For recreation and unite farmers from neighbouring villages and neighbouring country Malawi*
VIII. Internal middlemen; *Buys farmer produce at a very low price*
IX. Dispensary Njugilo; *Provide cure, prevention and education on health services*
X. Primary cooperative society Ipande. *Buys rice and cashew nuts*
XI. Ward extension worker WEW; *Provide agric extension advisory*
XII. External middlemen such as Mohamed Enterprises Fride Husein etc, they buy farmers produce at a very low price
XIII. District Council (DALDOs Office) offers agricultural *advisory services & coordinate .all agricultural activities*
XIV. Police station Kyela; *Ensures peace by enforcing laws and regulations*
XV. Primary court Busale; *Provides rights to farmers*
XVI. ARI Ilonga; Facilitate farmer to conduct research on improvement of soil fertility and to eradicate striga
XVII. Kikusya rice trial site; Screens and evaluate rice varieties.
XVIII. Secondary school Itope; provide secondary school e*ducation their children.*
XIX. Saving and credit KIODI; Provide loans to farmers
XX. KYERUCU District; Cooperative union; Sells agriculture inputs on loan and buys farmer produced crops

2.4.7.3 The Venn diagram developed by Uhuru farmer researcher group.



2.5 Kiswira Village Matombo - Morogoro rural District.

In this village work on rice/Striga started in 2003. Training was conducted on Striga life cycle and control measures during the two seminar village meeting held in September and November. During that time farmer formed a research group with a number membership of 18 including 6women.

2.5.1 Historical changes

a). Political;

- Multiparty system, This has improved democracy and freedom of expression by farmers
- Village leadership is strengthened by having sub-village leaders
- The society is not aware of the national policies
- Ruling party and government responsibilities have been separated.
- There is peace and harmony

b). Economic situation

- Rice production has dropped from 10 to 2 bags/acre over the past 20 years
- There has been a decline in fertility in farmer’s fields.
- The population has increased from 350 to 3324 Households
- Free market economy has affected the prices of rice.
- Abolition of boundary barriers trade has enabled middlemen from Kenya to come to our village to purchase fruits
- 85% of the land is owned by a Catholic Mission and, 15% owned by the Government. Farmers know little about the lease but they pay 1000/= to the mission for piece of lands they cultivate per year.
- Goats and pigs are kept

c). Cultural value of rice

- Rice and maize are the special food during festivals, dowry
- The yield drop has forced the society to change theft cases have increased.

d). Social changes

- Cultivation used to be done collectively but this is no longer practised
- Sale of agriculture inputs has been privatised and is being sold at very high price.
- Farmers are not aware of the importance of Extension officers in providing agricultural information and advises of agricultural problems
- There is a high incidence of theft of rice

e). Environmental

- Rains are very unreliable. Farmers think that is due to deforestation.
- Gully formation due to soil erosion.
- There is soil fertility depletion in farmers' fields hence increase in *Striga* infestation
- Occasionally there are outbreaks of insects and diseases.
- There are very few wild animals with an exception of monkeys, which are increasing.

f). Gender situation

No	Activity in rice production	Done by	
		Men	women
1	Land preparation and cultivation	X	
2	Planting	X	X
3	Weeding	X	
4	Harvesting	X	X
5	Who owns the produce	X	X

2.5.2 Farmer capacity to grow rice

a). Strength

- Muscle strength.
- Own small agricultural equipment e.g. hand hoes.
- Land is hired and limited.
- Seed is collected from previous harvest.
- Rice growing technologies are inherited from fathers.

b). Opportunities that are available.

- Animal manure and farmyard manure is available
- Extension officers are available
- Researchers are available
- Village government and District authorities support rice production
- Rice can be stored and sold later

c). Weaknesses

- No market information
- No records on agricultural activities are kept by farmers
- Poor practice of agriculture technologies
- Farmers don't look for agriculture information

d). Threats to rice production

- Drought
- Army-worm outbreaks

- The presence of *Striga* in their rice fields

2.5.3 Farmers experiences in growing rice

a). Success

Rice ensures ca 50% of household food security and good relationship with neighbours.

b). Problems and how they have been solving them

- There are outbreaks of birds; diseases and insect pests, farmer's complaint on them affecting yield of rice and have no solutions.
- Prices of crops are not attractive to farmers and nothing is being done to curb the situation
- The number of fields infested with *Striga* are increasing- *Striga* research has started
- There is poor or no record keeping and no measures taken
- Poor soil fertility – sometimes there is crop rotation of the following crops sesame or cassava. Maize is severely attacked by *Striga.*
- They lack agricultural information- no measure taken.

2.5.4 Researchers' experiences:

Training on Striga biology and control options has been conducted in the village. However it was noted that:

- Farmers are not creative to look for solutions to their agricultural problems.
- Farmers seem to have despaired as they are satisfied with yield obtained
- Farmers wanted to be given solution of their problems
- The research was not well understood in the first place, there is hope for improvement after this workshop.
- Striga knowledge is already with farmers from November 2002 seminars.
- They have to create a behaviour of teaching other farmers

Key issues

From the workshop analysis of the situation above, findings were analysed and summarised into the following key issues;

1. Farmers did not know the real situation of their village that affected the rice production.
2. Farmers' knew that maize/upland rice production has been reduced by *Striga* infestations from 20 to 5 bags of maize and 10 to 2 bags of rice per acre but did not visualise its impact. It was seen as a normal situation.
3. Farmers were not keen to keep records and participate in research on rice and use research findings

4. Farmers of Kiswira village have been depending on resources and knowledge from outside their village, which they cannot afford.

From the analysis all farmers agreed to start awakening and they developed the following challenge:
Farmers of Kiswira village wants to improve production from 2 to 10 bags for rice and 2 to 20 bags for maize per acre while improving soil fertility by complete eradication of Striga and improving soil fertility through research.

2.5.5 Strategies

Key issue no.	**What to be done**	**How to be done**	**By whom**	**When**
1 & 2	Train all other farmers	Making use of formal and informal gathering	All this workshop participants	From 30th January 2003
2.	Know the standard yield of various crops.	Telling your fellow farmers your yield and compare with the targeted yield to note the gap	All this workshop participants	From 30th January 2003
3	Farmers must have a goal, keep records and make use of them	To buy copy books, pen and rule	All this workshop participants.	From 30th January, 2003
4	Farmers must be creative	Depend and make use of the available resources	All workshop participants	From 30th January, 2003

2.5.6.Institutional analysis

This is a group of researcher farmers called **Uhuru** Institutions working/available in the area includes

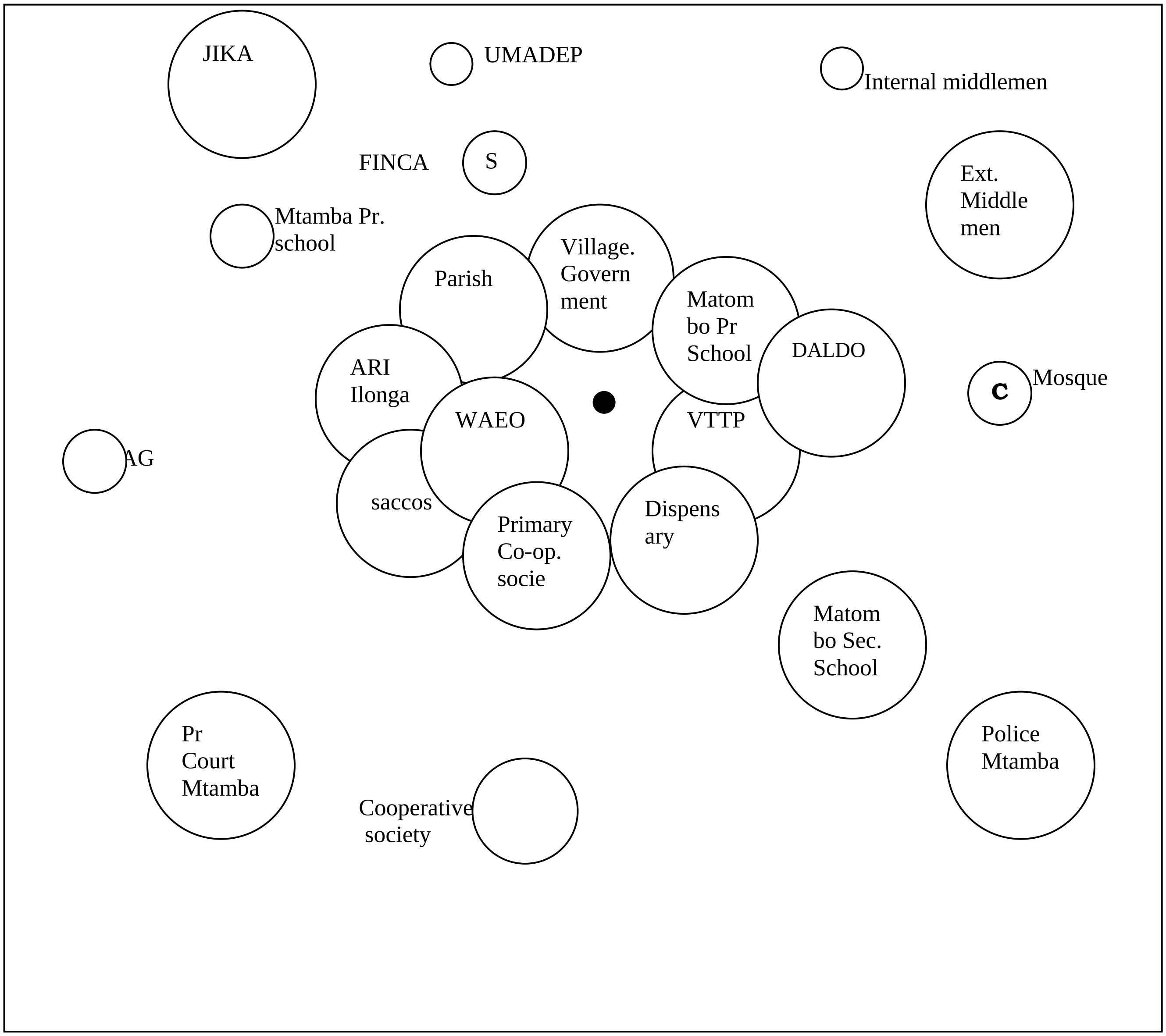
2.5.6.1 List of stakeholders working in the area

Within the village	Found outside the village
I. Primary school Matombo II. Village government III. Matombo Parish IV. Mission Dispensary V. Primary cooperative society VI. TAG church VII. SACCOS VIII. Internal middlemen	I. ARI Ilonga II. Mtamba primary school III. VTTP IV. District Council (Agriculture Health and Education) V. Ward extension worker VEW. (Agriculture and .health) VI. Primary cooperative society VII. Mtamba Mosque VIII. Outside middlemen such as , Mohamed Enterprises buyers from Kenya etc. IX. Police Station Mtamba X. FINCA XI. UMADEP XII. JICA

2.5.6.2 What services these stakeholders provide

I. Primary school Matombo; *Provide primary school education to children*
II. Primary school Mtamba; *Provide primary school education to children*
III. Village government; *Rule and governs the village*
IV. Matombo Parish; *Provide spiritual services*
V. Primary Cooperative society; *selling and buying small Agric inputs and farmer produce as well as household* commodities
VI. Internal middlemen; *Buy farmers produce at a very low price*
VII. Mission Dispensary; *Provide cure, prevention and education on health services*
VIII. TAG Church *Provide spiritual services. There are few served members*
IX. SACCOS Provide credit and loans to farmers
X. Cooperative society; *Farmer sells their crops but the price is low*
XI. Ward agricultural extension officer WAEO; *Provide agric extension advisory*;
XII. External middlemen such as Mohamed Enterprises Buyers from Kenya etc. *Buys farmer produce at a very low price*
XIII. District Council (Agriculture Health and Education)Offers *advisory services & coordinate .all agriculture health and education activities*
XIV. Police station Mtamba; *Ensure peace by enforcing laws and regulations*
XV. *FINCA; Provides loans to women in the village.* Only one member had accessed to the loan and is not known to many of the villagers
XVI. UMADEP; *NGO offering capacity building services on agro-forestry and other development activities*
XVII. JICA; *Offer extension services.*
XVIII. VTTP; *Deals with road construction.*

2.5.6.3 The Venn diagram developed by Kiswira farmer research group.



2.6.0. Kibangile Village Matombo Division Morogoro Rural District

The Striga research started September 2002 wit introduction of the research work and established a farmer research group. They received Marejea and pigeon pea for establishment of demonstration plots.

2.6.1 Historical changes

a). Political

- Multiparty system, This has improved democracy and freedom of expression among farmers.
- Village leadership is strengthened by having sub-village leaders
- The society is not aware of the national policies
- The party and government responsibilities has been separated
- There is peace and harmony
- The village encourage rice and maize production
- Women are not participating in leadership

b).Economic Situation

It was realized that rice and maize are the major crops

- Rice and maize production has dropped down; rice from 10 –2 bags/acre while maize from 20-2 bags /acre over 20 years.
- Farmers keep chicken (5-20 heads per household), ducks (5-20 per household) and goats (10 per household).
- Free market economy has reduced crop prices.
- Prices of agricultural inputs has gone up
- Farmers are allowed to carry cross border trade, there are many middlemen from Kenya in the village who buy fruits.
- Seed is recycled from year to year.
- A large portion of the land is under National reserve and part is rocks. The average area per household is 2 acres. Farmers practice mixed cropping.

c). Cultural value of rice

- Rice and maize are the special food during festivals and dowry, however this is changing slowly as cash is more usual.
- The yield drop has forced the society to change, hence theft cases are increasing.

d). Social changes

- Cultivation used to be done collectively. This is no longer the practice, delaying some field operations. Low productivity has led this tradition to stop.
- There is a lot of theft of crops

- The business of agriculture inputs has been privatized and now sometimes-fake products are being sold to farmers.
- About 15% of farmers have rice fields outside the village this has been facilitated by the District government. They're about 350 households in the village and the population is increasing.

e). Environmental

- Rainfall seasons have changed and are unreliable.
- Drought
- There is fertility depletion in farmers' fields hence increase in *Striga*
- Bush clearing for farms
- The wild animals and birds attacking their fields have increased due to nearby National Forest Reserve.
- Occasionally there are outbreaks of insects and diseases
- There is soil erosion
- The depth of water in rivers is decreasing by siltation
- There is a village environmental committee which is looking after the forest reserve

f). Cultural value of rice

Rice is a special food for adulthood initiation ceremony. During traditional rituals millet is used

- **Napier grass is planted at four corner of the field and at the centre to prevent *Striga*. It was believed to work however this has never been investigated.

g). Gender responsibility

There is a division of labour for crop production. Women undertake all rice production activities. Men and women jointly harvest both crops rice and maize, but at the end men control the produce and income.

2.6.2 Farmer Capacity to grow rice and Maize

a). Strength

- Muscular power.
- Hand hoes.
- Land.
- Health.
- Rice growing technologies are inherited from their fore fathers.

b). Opportunities

- Limited animal manures (most from chicken).
- Extension officers are available although not staying in the village
- Researchers are available

- Village government and District authorities support rice production
- Rice can be stored and sold later
- There is now a farmer research group
- *Crotalaria* is also available recently supplied by the project.

c). Weaknesses

- No market information
- No records are kept
- They don't look for agriculture information
- Targeted market is Morogoro
- Good agronomic practices are not put into practice

d). Threats to rice production

- Dry spell within the rain season especially after the short rains in January/February, rice is at vegetative stage.
- The presence of *Striga* in their rice fields, its ability to produce a lot of seed with long viability in the soil(15 to 20 years)
- Extension officers are not utilized by farmers

2.6.3 Farmers experiences

a). Achievements

Among other food crops, rice also contributes to ensure household food security and good relationship with neighbours.

b). Problems and solutions

- Outbreaks of insect pests and stalk borers. Spraying is done by extension officer
- Prices of crops are not attractive to farmers and nothing is being done to cub the situation
- The fields infested with *Striga* are increasing- Crop rotation with cassava or sesame.
- Dry spell- nothing is done there are no contour bands and rainwater harvesting measures. Irrigation is not practiced. Only deep tillage is done during cultivation.
- There is poor or no record keeping- no measure are being undertaken.
- Poor soil fertility – weeds are ploughed under
- They lack agricultural information- no measure
- Theft- individual farmers have to be vigilant.

2.6.4 Researchers' experiences

Training on Striga has been conducted in the village and control measures described. However it was noted that:

- Farmers do not keep records

- They don't look for agricultural information
- They seem to despair
- They must be proud at least of what they are achieving

2.6.5 Key issues.

From the workshop analysis of the situation above, findings were analysed and summarised into the following key issues;

1. Production of maize and rice has dropped, rice 10-2 bags /acre, while maize 20-2 bags/acre because of poor agronomic practices and *Striga* infestation
2. Farmers of Kibangile were not aware of the context of their village
3. Farmers do not keep records nor do they make use of them

From the key issues farmers agreed and developed the following challenge.

Farmers of Kibangile want to improve production of rice from 2 to 10 bags per acre and maize from 2 to 20 bags while improving soil fertility by eradication of Striga through research.

2.6.6:STRATEGIES

	What to be done	**How to be done**	**By whom**	**When**
1	Apply good agronomic practices	Workshop participants must do it practically	All workshop participants	From 31st January 2003
2.	Education to all farmers in the village	By telling your fellow your yield and compare with the targeted yield	All workshop participants	From 31st January 2003
3	Farmers must a collect and keep records and make use of them	To buy copy books, pen and rule	All workshop participants	From 31st January, 2003

3.0 List of Farmer Participants for Each Village.

I. Kilasilo village-Kyela
1.Aggrey Aliko
2.Sankey Kandonga
3.Air Kyoma F
4.Tusajigwe Isumo F
5 Ester Kubali F
6.Sinyagile Nambisa F
7.Z Nakajange F
8.S. Naswila F
9. Saidia Mwakafyuju
10. L Mwakapona
11 J.Mwakatage
12 A Mwakanyasi
13 K Mwasamwene
14.Kibatika
15. Alfred
16 E.R Mwaipopo
17.Oscar Mbonge
18 Asegelisye Mwaseba
19 Bernad Mwakalinga
20 Ruth Kaluma F
21 Rhighton Msenyenye
22Modem Kyamba

II. Itope Village-Kyela
1.Abdallah Mbalangwe
2.Mwema Hamisi –chairman
3 Asajenie Mwakitubwa
4 Samson Mwakanyamale
5 Yusuf Kayui
6 Edward Mwang'onda -Secretary
7.Fatuma Mwakanyamale-F
8.Rehema Mwalaba-F
9 Hamisi Mwema
10. Christopher Mwaisabila
11. Tereza Mwisabila-F

III. Njugilo Village-Kyela
1.Robert Mwailubi-Secretary
2.Andwele Mwakasege
3.Jackson Salim- Chairman
4.Philimon Mwakasege
5.Fransis Mwaisumo
6.Steven Mwangalaba
7.Jason Mwasege

IV. Sinyanga Village - Kyela
1.Lusekelo Kawilo- chairman
2.Frank Panja
3.Bosco Njetile
4.White Mwansasu
5.Rabson Kaposolo
6.Neema Bukuku
7.Mbutolwe Panja- Secretary (left for teachers college training)
8.Henry Simfukwe
9.Israel Mwaijande

V. Kiswira Village-Matombo
1.Adolf Mawango-secretary
2.George Mkami-chairman
3.John Msimbe
4.Aloys Dominic
5.Vicent Alban
6.Wilvina Damas
7.Michael Roman
8.Otto Mzeru

VI. Kibangile Village-Matombo
1.Pili Mohamed
2.G. Joseph Mkoba
3.Abdul Rajabu
4.Jumanne Rashid Mpeka
5.Filbert Roman
6.Beatus E Kunambi
7.Angela Aloys
8.Josephine Amos- secretary
9.Mzeru H Mbaruku
10.Salehe Ahmad-Chairman

MONITORING DEMONSTRATIONS OF SOIL FERTILITY ENHANCING PRACTICES

Kyela and Morogoro Rural Districts.

PROJECT WORKING PAPER NO 3

A. M. Mbwaga ARI Ilonga, Kilosa Tanzania
Charlie Riches Natural Resources Institute UK
16th May 2003

Preface

Striga species, the parasitic witchweed, are wide spread in small holder crops in semi-arid and sub-tropical regions of Eastern and Southern Africa. These weeds attack and reduce the yield of maize, sorghum, upland rice and finger millet in these regions. In many areas it is the crops of resource-poor households, which are particularly affected. They impose additional stress with which farmers, who have little resources for investments in crop production, have to cope in an environment characterised by marginal rainfall for cropping and declining soil fertility.

Since 1996 staff from the Department of Agricultural Research Development, Sokoine University of Agriculture and Extension in Tanzania and, Natural Resources Institute in UK have collaborated to develop integrated Striga management practices for rice crop. Studies have been undertaken with groups of rice farmers in Kyela district, in the Southern Highlands of Tanzania. Through on-farm trials farmers came to appreciate that Striga infestation and poor rice production are associated with and indicators of low soil fertility. This in turn is a consequence of continuos rice cultivation in the absence of using any fertilizer or manure. While the field trials demonstrated that up to a 60% reduction in Striga numbers and a 40% increase in rice yield is achieved by using urea fertilizer, farmers decided they did not wish to invest scarce cash in fertilizer. Instead they became interested in the opportunity, also observed from the field trials, to improve rice productivity on Striga infested soils by introducing the green manure crop *Crotalaria.*

The current project is on "*On-farm verification and promotion of green manure for enhancing upland rice productivity on Striga infested fields in Tanzania*". It is operating from October 2002 to March 2005 with aims to scale up the demonstration of using the green manure in rotation with rice in both Kyela (Mbeya Region) and Matambo (Morogoro Region).

The purpose of this report is to outline the activity performance of the project, which involved mid season group evaluation of demonstration plots, which were planted in the 2003 rice-growing season.

Further information on the project or further copies of previous reports are obtainable from:

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1. Enhancing productivity of upland rice on Striga infested soils: Village Meetings to design the demonstration Programme Kyela-Matombo Report 2003, Mbwaga A.M and Riches C.R.

2. Context Analysis for four Villages in Kyela and two villages in Matombo-Matombo rural districts
Working paper N0. 2: 2003
Lameck, P, Mbwaga, A.M.

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Project Team Members participating in the Monitoring and Evaluation:

Dr A M Mbwaga - Plant Pathologist/*Striga* specialist, ARI Ilonga (Project Leader)
Mr C Massawe – Agronomist, ARI Ilonga
Dr G Ley – Soil Scientist, ARI Mlingano
Dr J Hella – Agricultural Economist – Sokione University
Mr P Lameck – Social scientist – INADES
Mr J Kayeke – agronomist and post graduate student, Sokione University
Dr C Riches – weed scientist, Natural Resources Institute, UK

In Kyela:

Mr Mwambungu – District Agricultural and Livestock Development Officer
Mr Mwampaja – Village extension worker
Mr Mwangosi – Village extension worker

In Morogoro Rural:

Ms. Masangya – District extension officer
Mr H. Kisumo – Village extension worker

Content

Background

Poor yields of *Striga* infested upland rice are associated with low and declining soil fertility. A context analysis undertaken with farmers in four villages close to Lake Nyasa, in Kyela district (Mbeya Region) has indicated that as infestations by *S. asiatica* have increased rice yields have declined from approximately 20 bags per acre 20 years ago to little more than 2 bags per acre today. A similar situation has been reported by farmer groups in two villages in the Uluguru Mountains of Morogoro Rural District (Morogoro Region). Here, *Striga* is also a serious problem in maize, also an important food crop in the district. On-farm trials undertaken by farmer groups collaborating with CPP funded project R7564 in Kyela demonstrated how rice yields can be increased by 25-50% by application of 25-50 kg Nitrogen ha^{-1} while the infestation level of *Striga* is decreased. The majority of farmers are not however prepared to invest their limited cash in fertiliser.

An alternative strategy is to improve the fertility of *Striga* infested fields by growing legumes in rotation with susceptible cereals. From initial trials with the green manure Marejea (*Crotalaria ochroleuca*) the farmer research groups in Kyela observed that rice performs in a similar way when planted following a crop of the green manure *Crotalaria* as it does when treated with urea. This practice therefore offers farmers a low cost approach to soil fertility enhancement to improve rice productivity on *Striga* infested soils. Pigeon pea is also known to increase soil nitrogen levels and is a well-known crop in both Kyela and the Uluguru Mountains. Locally available varieties are however late maturing and susceptible to the wilt disease *Fusarium udum*. Work by Ilonga Agricultural Research Institute has led to the selection of medium duration, disease resistant lines, which have been favourably evaluated by farmers. With project R7564 due to end in March 2003 it was decided to scale-up promotion of legumes used in rotation with rice to enhance soil fertility of *Striga* infested land. The current project is therefore undertaking promotion work in four villages in Kyela, including the two where on-farm trials were on-going, and has extended activities to two villages in the Uluguru mountains. The key activity involves a series of on-farm demonstrations, managed by farmers following training and with support from district extension staff and the project team. This report summarises observations made prior to harvest of demonstrations planted in the 2002/03-crop season.

Methodology

The use of *Crotalaria* or pigeon pea in rotation with rice to combat *Striga* and low soil fertility had been introduced in Kilasilo and Itope villages in Kyela prior to the 2001/02 crop season when farmers were provided with seed for on-farm trials. During discussions with farmers it was subsequently agreed to incorporate these into the demonstration programme in each village. Plots previously planted to *Crotalaria* or pigeon pea in 2001/02 were planted with rice in 2002/03. Village seminars were held in Sinyanga and Konjula in Kyela and in Kiswira and Kibangile in Morogoro Rural in September to November 2002 to introduce farmers to the potential benefits of the legume/rice rotations. Farmer groups were then formed within each village to undertake demonstrations at a number of sites. It was agreed that at each site there would be single plots, side by side, of *Crotalaria,* disease resistant pigeon pea and rice. All plots would be planted to rice in the following season.

The farmer group in their respective villages visited all sites between 6th and 11th May accompanied by a multi-disciplinary project team. At each site the host farmer described the demonstration, provided information on dates of field activities. Farmers were encouraged to discuss what they had observed so far during the season. Following the field visit findings were summarised and a group discussion held to confirm aims and objectives of the on-going programme and future work.

Observations

Kyela District

Kilasilo village

This is one of the two villages in which on-farm trials with *Crotalaria* and pigeon pea had previously been undertaken. Seventeen farmers, including six women, participated in the plot monitoring and subsequent group discussion. The performance of rice planted following either *Crotalaria* or pigeon pea was observed at seven sites and new demonstration plots of the legumes have been planted at 10 sites. These will be planted with rice next season. Observations made at each site are presented in Annex 1. A summary of the situation in Kilasilo follows.

- Excellent collaboration between the group and extension staff; the group secretary has maintained good records of activities at all sites. Most group members are clear about the objectives of the demonstrations and can explain the potential roles of the legumes in the cropping system.
- Previous interaction with the project team and extension staff during the on-farm trial phase, frequent discussion and active group leadership has resulted in strong ownership of the demonstrations by group members in Kilasilo. The village chairman is playing an active role in the group, which appears to enhance cohesion.
- Considerable interest is reported from other farmers in the village who have seen the demo plots. This group appears ready to host field days at a few selected sites for other villagers.
- Demonstrations are generally well laid out, were planted on time and have been well managed. In some cases the "lie of the land" had not been considered when deciding plot location and this needs to be emphasised in future.
- Strengths of *Crotalaria* perceived by farmers: increased vigour, colour and tillering of the following rice crop; yields after the green manure are expected to be higher than in continuous rice. Less weed growth is seen in the subsequent rice crop - in a number of cases continuous rice was weeded twice while rice after *Crotalaria* was only weeded once. Weakness of *Crotalaria*: land is taken out of food/cash crop production for one season. However many farmers pointed out that on areas which are infested by *Striga* the rice yield is now so low that little yield is actually foregone.
- Strengths of pigeon pea: new varieties mature earlier than local types; following rice crop grows well. Weakness of pigeon pea: The crop does not suppress weeds.
- There is a shortage of land in Kilasilo and many households rent plots from other farmers. However, rental contracts are limited for two years. Farmers planting *Crotalaria* in the first year of the contract are potentially increasing the fertility of land they must subsequently return to the owner. Pigeon pea may therefore be a better bet on rented land with farmers planting *Crotalaria* on their own land.

- Farmers report an increasing demand for *Crotalaria* seed. Group members wish to increase the areas planted on their fields while other farmers are showing interest in planting the green manure also. A number of group members indicated that they would give some seed to others. All the plots planted in Kilasilo this season used seed harvested from on-farm trials the previous year. As plot size has increased considerably, as farmers gain more confidence, of there should be more seed available for harvest this season. It will be interesting to see if seed sales begin.
- Analysis of soil samples taken from demo sites in Kilasilo, and indeed in other participating villages in Kyela, has shown the soils to be very acidic (pH 4.5 to 4.8) deficient in nitrogen, and very low in phosphorous. While using legumes can increase nitrogen status, acidity and phosphorus will remain a problem.
- As farmers learn more about using *Crotalaria* and the new pigeon pea varieties they are experimenting with other plots beyond the demonstrations and are planting additional areas to multiply seed. This process needs to be documented carefully.

Itope

Some of the farmers participating in the demonstration programme in Itope were also members of the farmer research group and have been involved in on-farm trials with urea and *Crotalaria* since 1997. Nine farmers, including one woman, visited the field sites and attended the group discussion to monitor progress with the current demonstrations. The performance of rice planted following either *Crotalaria* or pigeon pea was observed at eight sites and new demonstration plots of the legumes have been planted at six farms. These will be planted with rice next season. Observations made at each site are presented in Annex 1.

- Despite continued interaction with the project team and extension staff, participation by farmers beyond an enthusiastic core of group members in field activities has been disappointing. This seems largely due to poor group leadership and management. The farmer who has been group leader for some time is not committed to the work unlike some of his younger colleagues. It is understood that following this visit by the project team the group held a meeting and persuaded the current chairman to step down to make way for a more enthusiastic leader. Participation by women is particularly poor despite previous assurances from members that they would encourage their wives and other women to become involved.
- A number of sites had been planted later than other crops on the farm and some participants had clearly given the demonstrations. Record keeping has also been incomplete.
- Some of the demonstrations are on small pieces of land away from the main fields. In future all farmers should be encouraged to embed the demonstrations within their main fields and plant the plots at the same time as their main crops.
- Despite these problems a number of good demonstrations with large plots of *Crotalaria* and pigeon pea and follow up crops of rice have been established. As in Kilasilo the effect of the legumes in rotation is clear with the subsequent rice crop performing well. Farmers picked out the increased vigour of rice, and reductions in weed and *Striga* infestations in rice following *Crotalaria.*
- Most farmers in Itope own their own fields so *Crotalaria* would appear to be an ideal technology for the village.

- All *Crotalaria* plots have been planted with seed produced in the village in 2002. Farmers indicated an increasing demand for seed. Some participants wish to increase the area they are planting while a number of non-participants have requested seed for next season. One farmer has planted a particularly large area for seed multiplication and intends to sell seed at Tsh. 600 per kg.

Sinyanga

The farmer group was formed in Sinyanga following the village seminar in September 2002 held to introduce farmers to the potential advantages of using legume rice rotations on *Striga* infested land. Ten farmers, including one woman, attended the field visit and group meeting. Prior to the season the group had agreed a demonstration layout and seed was provided by the project to 12 farmers. Of these 10 planted but due to erratic rain, drought and other problems only 2 sites have survived. A reasonable stand of *Crotalaria* although this had been late planted.

- Farmers in Sinyanga have access to a large are of lowland and their priority is to establish rice here by February. Upland rice is a secondary priority for many households.
- A number of farmers who had received seed indicated that they did not have enough knowledge about when and where to plant *Crotalaria*. They were also unclear about the potential benefits despite a number of visits by the extension worker. The men had not discussed the demonstrations with their wives.
- This is a new group, which so far appears to have little ownership of the programme. The plots are seen more as a research activity for the project team than an extension activity for the community.

Konjula

The farmer group in Konjula was also formed following a seminar in the village in December 2002. Unlike Sinyanga there is considerable enthusiasm among group members to undertake the demonstrations and learn about the use of *Crotalaria* and pigeon pea. Although there are extensive lowland fields here farmers are still interested in improving production in upland rice and maize. *S. asiatica* and *S. forbesii* are both problems. Demonstration plots are widely scattered and only 5 members of the group, including one woman, participated in the field visit and subsequent discussion. The project had provided 12 farmers with seed. Six farmers planted and five demonstrations have survived the drought. At one site the *Crotalaria* emerged but was mistaken as a weed and was removed by children sent to clean the field.

- The group is very interested in the demonstration programme and leadership appears strong. Some farmers did not plant because of the drought at the beginning of the season.
- Those who did plant established large plots of *Crotalaria*. Pigeon pea was not planted as fields are often at some distance from houses and farmers indicated that seed would be stolen.
- *Striga* was observed in a number of rice crops during the tour of the plots. Farmers indicated a number of areas, which had been abandoned because of low yields. They were impressed by the weed suppression achieved by *Crotalaria* and suggested that it

will be easier to prepare land after *Crotalaria* than after a weedy fallow. Having seen the vigorous growth of the plants they are expecting improved rice yields next season.

- Farmers with demonstrations indicated that their neighbours have asked about the plots and have requested seed for next season. It was agreed that all plots of *Crotalaria* would be retained for seed production and that if possible seed will be given to other farmers for next season.

Above: Farmers observing Mwang'onda's rice field, grown after Crotalaria, behind is Crotalaria, Itope 2003

Farmers observing the performance of pigeon pea Variety Mali (Late maturing,resistant to wilt disease). Kilasilo, June 2003.

Morogoro Rural

Kiswira village

This is the first season of work on *Striga* in the district. The farmer group was formed in Kiswira following the seminar held here by the project in September 2002. The Uluguru Mountains have a bimodal rainfall pattern. Upland rice, maize and sorghum are planted on the short rains (October to early January). Because it is a long season crop it is important to plant rice early. The crop is also a planted on wetland valley bottom site. The long rains usually begin in mid-February following a few weeks of dry weather. Maize is the major crop on the long rains and rice is not planted. Rice is not therefore the dominant crop. Upland rice is often grown on steep, rocky slopes, which are farmed within a bush fallow rotation. The fallow period is about three years although this is said to be reducing due to population growth. A number of fields with very poor rice and maize crops were seen on steep, eroded fields in both Kiswira and Kibangile. Because rice and maize are both important and are infested by *S. asiatica* farmers were left to choose which crop to plant on demonstration plots

A total of 16 farmers participated in the field visits and group discussion. The group included nine women. Seed of pigeon pea and *Crotalaria* had been supplied to 18 farmers. Plots were planted at 11 sites but due largely to the drought only six have survived. The short rains failed almost completely with only isolated showers falling in late December and mid-January. The long rains have also been erratic. Farmers pointed out that this has been a most unusual year, and it has been difficult for them to decide when to plant. As a consequence the area planted to rice this season is less than usual and many crops are now drought stressed and will produce low yields. Farmers have planted maize in the long rains but these crops are also poor.

- The demonstration plots have been given low priority. This is partly due to the difficult climatic conditions. Farmers planted pigeon pea first and in general have very good stands. This is an established crop in the area and farmers are very interested to follow the performance of the variety supplied by the project. This matures earlier than local varieties. *Crotalaria* on the other hand was planted later and in most cases failed to establish despite replanting. This crop is not tolerant of drought in the seedling stage. Most farmers planted in January, prior to the dry spell ahead of the long rains. The late planting was associated with a lack of knowledge of how *Crotalaria* grows and how it can be used in the cropping system.
- Farmers in the area use a minimum tillage system for crop establishment. Crop residues and weeds are cleared and burnt prior to planting. Deep tillage is not undertaken. Crops are usually planted on the flat so opportunities for incorporation of *Crotalaria* or pigeon pea residues within the current system are limited. The alternative will be to retain mulch of biomass rather than burning crop residue.
- It was agreed that the plots of *Crotalaria* that have survived would be used for seed multiplication. Some participants reported that other farmers are also asking for seed.
- When the demonstrations were planned group members discussed including plots of the cover crop legume "kiraka" (*Pureria phaseoloides*). This was introduced as a ground cover for use in tree crops many years ago and has become naturalised in the area. Farmers did not plant any plots as they failed to collect seed. One lady farmer described how she grows maize on a field where kiraka has become established. She slashes down the plants and sows maize into the mulch.. During the crop season she

slashes the re-growth between maize plants. This is said to result in good yields. While this may well be a good system for maize production, kiraka is highly competitive and persistent and would be very competitive to young rice.

Kibangile

The cropping system here is similar to that in Kiswira. Sixteen farmers, including four women, participated in the field visit and group discussion. Of 14 who had received seed from the project nine planted plots. Of these five have survived the drought. Fields are widely scattered and there was only time to visit four sites.

- This is a well-led group and a number of the members have tried hard to establish plots despite the weather. Most farmers gave highest priority to pigeon pea and there are some very good stands on the demonstrations. *Crotalaria* planted in late December or early January was affected by the dry spell preceding the long rains. This is clearly not a good time to plant. The best plot of *Crotalaria* was planted following the onset of the long rains and is now producing seed.
- Farmers estimated that 25% of fields are in bush fallow rotation. It may be difficult to establish *Crotalaria* on the gravel soils of the upper slopes, particularly when rainfall is erratic as has been the case this season. However a possibility would be to plant the crop as the land is returned to fallow. It was also suggested that *Tephrosia* might be a better green manure crop for improving the fallow. *Crotalaria* is better suited to continuously cultivated fields.

Most of the demonstration plots are a considerable distance from the main road and major paths. New sites selected for next season should be located along major paths, which lead to markets.

Farmer with his Crotalaria crop
It has reached the stage of incorporation in the soil.

Mr. Laison Kayuni,
Itope 2003

Conclusions and Future activities

Group performance

The ownership of the programme by and commitment of the farmer groups to undertake the demonstrations varies considerably between villages. The difficult weather conditions have clearly not helped while in the "new" villages this season has been the first experience the groups have had with *Crotalaria* or with planting what they view as research plots. Good leadership and group management are essential and have been key in the success of the Kilasilo group. It was therefore agreed that the project team should provide more support to the groups in the form of training. It is proposed that this will be undertaken by INADES and will include training on leadership and discussion on the roles and responsibilities of group members. In addition it has been suggested that further groups may be formed for women or younger farmers in some villages e.g. Itope. INADES is to follow up the Context analysis by collecting more information on the range of institutions found in each village. Formation of new groups will depend on the outcome of this work and further discussion with farmers. This work will take place after the current season has ended, probably in July.

Some of the groups involve village leaders and this is thought to have a positive influence on activities. It was agreed that team members to take more time to visit village leaders, when then are undertaking fieldwork with the groups.

Farmer exchange visits and field days

Arrangements for a series of field days were discussed and agreed with extension staff. Farmers, village extension workers and district staff from Morogoro Rural will visit sites in Kilasilo and Itope in late May. The groups in Kiswira and Kibangile will each select five farmers to make the trip. This will provide an opportunity for them to see a number of sites where farmers are growing both *Crotalaria* and pigeon pea in rotation with rice to learn from farmers in Kyela how they are managing the demonstrations and what they consider to be the advantages and disadvantages of each crop. Farmers from Morogoro Rural will be able to learn the methods used in Kyela for incorporating the biomass prior to the next rice crop and how *Crotalaria* seed is harvested and stored. They will then give this information to other members of their groups when they return home.

Similar exchange visits will be arranged for farmers from Sinyanga and Konjula. It is hoped that seeing the performance of rice after the legumes in the field at Kilasilo and Itope will give them more confidence to afford a higher priority to the demonstrations in their villages next year.

Extension staff will also organise field days at selected demonstration sites in Kilasilo and Itope to promote the use of rice/legume rotations to farmers who are not members of the farmer groups. It will be important to monitor who attends and requests seed for subsequent follow-up.

Information resources

As the use of *Crotalaria* increases farmers have been learning how to manage the crop. The issues needing particular attention are:

- where and when should it be planted? - *Crotalaria* appears most suitable for use on land which is owned rather than rented, unless the rental period is long enough to justify the investment of labour in improving soil fertility. Similarly, for the Uluguru Mountains, the green manure may be useful on continuously cultivated fields. The seedlings are not tolerant of drought and planting needs to be at the start of the most reliable periods of rainfall.
- how should the biomass be managed? – Farmers in Kyela who have access to draught animals and ploughs can incorporate the whole plants. Others have used hoes to bury the biomass in ridges. Farmers in Kilasilo have observed that rice growth is better after incorporating *Crotalaria* although rice also performs better after using the biomass as mulch than where the green manure has not been planted. Farmers in the Uluguru Mountains do not undertake deep tillage and may need to rely on using the biomass as mulch.
- how should the seed be harvested? Likely options are to pick pods as they ripen or to cut the top branches with pods. These can then be dried for threshing later. As much biomass as possible should be left at the field.

Clear information on these and other aspects of rice/legume rotations for the management of *Striga* infested land needs to be made available to farmers and extension. Leaflets or posters in support of the demonstration programme will also be particularly useful for promotion work beyond the core farmer groups and for scaling up to new villages. A farmer leaflet has been drafted and now needs to be finalised prior to pre-testing with farmers. The final draft will be tested by INADES in collaboration with district extension officers. It was also agreed that it would be useful to prepare a training manual for extension officers. This will provide more detail on the technologies. Dr Riches agreed to prepare an initial draft, which will be circulated to other members of the project team.

Socio-economic issues and continued monitoring

A baseline survey was completed in each village during April. A total of 177 households were interviewed, including group members and non-participants. The data is now being entered and Dr Hella expects to have completed a report on the data by the end of June. This will provide further insight on livelihoods and wealth categories in the community. This information may help explain future adoption patterns of rice/legume rotations.

The groups are recording data from each demonstration site with assistance from village extension officers on a standard pro-forma. This includes dates of all operations, how these were undertaken (e.g. incorporation of *Crotalaria*) and *Striga* counts. Yield estimates will be made for all pigeon pea, rice and maize plots. This will include the cereal yield at sites where *Crotalaria* is being grown for the first time in order to assess the grain production foregone by planting the green manure.

Soil nutrient deficiencies

In addition to very low levels of nitrogen, the deficiency most closely associated with the build up of *Striga,* the soils in Kyela are acidic and deficient in Phosphorous. Details of soil analysis completed at Mlingano for samples taken from a selection of demonstration sites will be presented in a forth-coming report. Previous observations and the positive response of rice growth seen on the demonstrations indicates that rotation with *Crotalaria* or pigeon pea has the potential to raise yields in a similar way to using nitrogen fertiliser.

The problems of acidity and phosphorus remain. In the long term it may be possible to select rice varieties which are tolerant to acidity and reports on this issue from elsewhere will be consulted.

There has been some interest in Tanzania in exploiting deposits of rock phosphate as a potentially cheap source of fertiliser. Rock phosphate is not as yet commercially available. While field trials may well show a benefit of combining green manure and phosphate applications it is not clear that the results could be extended to farmers in the near term. The project team will consult on this issue with the national soil fertility initiative before deciding whether or not to include phosphate applications at a limited number of demonstration sites in 2004.

*Crotalaria s*eed supply

Significant quantities of *Crotalaria* seed will only be harvested in Kilasilo, Itope and Konjula. With farmers intending to increase plot sizes in 2004 and non-participants already asking for seed it is possible that there will be insufficient seed to meet demand with in the project next season. The situation will be assessed in October but if more seed is needed arrangements will be made to purchase more from Peramiho Mission in Ruvuma region for distribution in participating villages.

Future planning with farmers

Meetings with all groups will be held in October in each village. The meeting will provide an opportunity to assess progress, discuss yields from the 2003 season and plan for 2004. New groups can also be formed at this time. A summary of project activities in the coming months with lead responsibilities is shown below.

Action	**Responsibility**	**Target Date**
Farmer exchange visits – Morogoro to Kyela and within Kyela	Mbwaga	End May
Field days for Kilasilo and Itope	Mwambungu, Mbwaga	Mid June
Finalise extension leaflet	Lameck, Mbwaga, Team	ASAP
Field test extension leaflet	Lameck	End August
Draft training manual	Riches, Team	End August
Complete Questionnaire report	Hella	End June
Complete soil analysis report	Ley	End June
Investigate scope for work on phosphate	Ley	End September
Institutional analysis	Lameck/Mbwaga	mid July
Follow up seminar with teachers	Mbwaga and Lameck	11-12 & 18-19 July
Collect crop yield data	VEOs, Mbwaga	Mid-July
Group training	Lameck	End July?
Group meetings to discuss results/plan 2004 Form new groups?	Mbwaga, Team	October

Annex 1. Status of demonstration plots in mid-May 2003.

Kilisilo village – Kyela District		
Farmer	**Plots planted**	**Comments**
Ruth Katuma	Pigeon pea *Crotalaria* – second sowing 15/2/03 Rice – 15/1/03 Pigeon pea in separate area of field to *Crotalaria* and rice	Good crop of pigeon pea; *Crotalaria* about 50 cm tall and rather weedy – first sowing did not germinate due to drought. Rice is yellow, nutrient stressed and stunted. Field said to be infested by *S. forbesii* but none emerged as yet. Farmer is interested in a pigeon pea/rice rotation to see if this reduces *Striga*. She has never used fertiliser or manure. Other farmer's poi9nted out that plots of each crop should be side by side for ease of comparison.
Group Chairman Asegelisye Mwaseba 	First area under cassava last year and previously cleared from bush: Rice planted 20/1/03 Pigeon pea planted 20/1; 12/3 & 4/4 *Crotalaria* planted 13/3 Second area where *Crotalaria* was planted last season: Rice at flowering following incorporated *Crotalaria* (on 20/12) or where seed was taken and *Crotalaria* left as mulch. Also a plot of rice on which urea has been used and area where no green manure or fertiliser has been applied Has also planted *Crotalaria* on a flood plain field to improve soil fertility.	This area was selected for the demo as farmer had previously seen *S. forbesii* in surrounding grass; rice look rather poor, droughty and not yet flowering; pigeon pea is still young. *Crotalaria* is excellent stand at about 80 cm tall. This is an excellent demonstration with clear difference between plots. Farmer thinks rice is best following incorporation of *Crotalaria* but is also good where seed has been harvested. Clearly rice here is better than on unfertilised area – taller, greener, more tillers. Vigour of rice following *Crotalaria* or use of urea appears similar. Farmer also noted residual effect of *Crotalaria* on weeds in rice. After *Crotalaria* he weeded one but in continuous rice he had to weed twice. Although incorporation of the green manure is labour intensive farmer considers extra work is worth it as leads to a vigorous rice crop. This plot is on rented land and has to be returned to owner next season. However farmer still thinks it is worth foregoing a rice yield for a season to grow *Crotalaria* to improve production in second year.

Farmer	Plots planted	Comments
Bernard Mwakalinga	Rice after incorporated *Crotalaria* *Crotalaria* just planted on area to be used for rice next year	Very clear improvement in rice vigour (height, tillering, colour and better stand) following *Crotalaria*. Weeded rice once but indicated that there was a lot less weed in rice following *Crotalaria* than in continuous rice. Farmers' main field is badly infested by *S. asiatica* and he says he would put the whole area into *Crotalaria* next season if could get enough seed and rent another field for his rice. He pointed out the yield is now so low that he will not loose much if he puts in *Crotalaria* for a year. Also reported that a number of farmers have visited his plot and have asked for seed for next season.
Saidia Mwakafyuju 	Pigeon pea, *Crotalaria* planted 5/2/03, Cannavalia, cowpea and rice.	Farmer joined the group this season. Pigeon pea excellent, now coming into flower. *Crotalaria* is excellent stand, vigorous now producing first pods. Excellent weed suppression. *Muccuna* had also been provided but this did not germinate so farmer used spare plot for cowpea. this is also a goods stand but biomass will not be a high as produced by *Crotalaria*. *Cannavalia* stand a little patchy, plants now in flower. Rice typical of crops in area – poor vigour. Site lies on a good location for demo as it is right on the main road through village.
Aggrey Aliko	Pigeon pea planted 23/11 *Crotalaria* planted 24/1 Rice	Site on edge of floodplain. Excellent growth of pigeon pea, now flowering but has been strong weed growth – has been slashed. In contrast weeds suppressed in adjacent plot of *Crotalaria* now producing first pods. Very good size plots in main field.
Alfred Mwamndela	Rice following pigeon pea Pigeon pea, *Crotalaria* and rice	Good size plots. Rice following pigeon pea looks vigorous; farmer says it looks better than in previous years.
Amani Mwandenuka	Rice following *Crotalaria*	Small plot under trees on edge of compound. No control area of continuous rice for comparison. Some *Striga* seen in the rice which is however growing well. Difficult to make any useful comment at this site. Has not followed up with new plots this year.
Kibateka Mwandenuka	Rice following *Crotalaria* Continuous rice – planted 10/3 *Crotalaria* Pigeon pea	Plots on dry eroded valley side. Gravel soil. Pigeon pea over run by weeds. Farmer pointed out that *Crotalaria* reduces weed cover in following rice
Jaili Mwakatage	*Crotalaria* planted 24/1	Farmer sold *Crotalaria* seed last year to the project for Tsh. 600 per kg. Has

(First farmer to plant *Crotalaria* on project)	Pigeon pea planted 28/2 Rice	now planted area of 70 m x 17 m. He is convinced from previous plots that it boosts following rice yield. Other farmers have been to the farm to learn about *Crotalaria* and he gave some seed last year. Now he intends to sell the seed. This is an excellent plot now producing pods.

Farmer	**Plots planted**	**Comments**
Sanky Kandonga	Rice following *Crotalaria* *Crotalaria* Pigeon pea Rice	Plots of *Crotalaria* and pigeon pea planted this season are growing well and now flowering. Rice following incorporated *Crotalaria* does not look very vigorous and is infested by *S. asiatica.* Rice after *Crotalaria* mulch looks comparatively good. But rice was planted in December and caught by drought in January and early February. Some of effect seen here seems due to moisture as there is good rice after *Crotalaria* in low spot of field. Also farmers think this site has very low fertility and suggest growing *Crotalaria* for two seasons.
Erasto Mwaipopo (adjacent to Juma trial site) 	Rice after pigeon pea planted 28/12 Pigeon pea, *Crotalaria*, rice (Photo) Rice after *Crotalaria* *Crotalaria* for seed production	Rice following pigeon pea shows excellent vigour and high tillering. Has been weeded twice. Continuous rice in adjacent plot is more yellow, shorter and has less tillers. Half of the *Crotalaria* planted this season has been incorporated already by making ridges. The rest will be retained for seed production. Plot of rice following *Crotalaria* stands out as a green strip across the field compared to poor growth of continuous rice! *Striga* infested rice plants are tall and vigorous where *Crotalaria* had been grown last year. Seed plot now podding.

Itope village – Kyela District		
Farmer	**Plots planted**	**Comments**
Laison Kajuni	Rice following *Crotalaria* *Crotalaria*	A rather patchy stand of rice which was planted in early March following *Crotalaria* last year. Farmer says it is looking very good considering no fertiliser was applied. The plants have many tillers and are a good green colour. Last season he planted 100 m^2 of *Crotalaria* but this season has a much larger area. Also has a plot for seed multiplication. He plans to plant much more next year when he has more seed as he has seen benefit to rice. Neighbours have also been asking for *Crotalaria* seed.
Samson Mwakanyamale	*Crotalaria*, pigeon pea, rice	First season participating in the group. He used to harvest 20 hags per acre but had given up the field in which the demo plots are due to poor yields and *Striga* infestation. There was no crop here last year. Excellent weed suppression by *Crotalaria* compared to dense cover of *Calopogonium, Ageratum* and *Sida* on adjacent plots. Pigeon pea and rice were planted early March. The rice has been water logged during late April. Farmer has also planted a small plot of *Crotalaria* for seed multiplication.
Edward Mwang'onda	Rice following *Crotalaria* *Crotalaria*	Farmer pointed out big improvement in crop vigour, colour and tillering of rice following *Crotalaria* – clear to see. Farmer is expecting a higher yield. Continuous rice and rice after *Crotalaria* both weeded once but farmer reports less weed after *Crotalaria*. Other farmers have visited the plot and asked what *Crotalaria* is for. One has asked for seed.
Asajenie Mwakitubwa (adjacent Juma trial site)	Rice following pigeon pea Rice following *Crotalaria* *Crotalaria*	The rice after pigeon pea looks poor, yellowish with few tillers. After *Crotalaria* the rice is much greener, taller and with many tillers. A neighbour commented how this is a much better crop than on the farm last year when rice yield was very low. The farmer here plans to keep the *Crotalaria* plot the size it is now each year and to rotate the green manure with rice. He plans to give seed to neighbours who have asked for some.
Abdallah Balangwe (Variety trial site)	Rice after Crotalaria (planted 17/3) Continuous rice (20/3)	Rice after *Crotalaria* is much greener, taller and has more tillers than continuous rice. both plots weeded once but it was necessary to weed continuous rice much earlier than other plot. No *Crotalaria* planted this year

		due to family problems.
Mwema Hamisi (Chairman)	Rice after *Crotalaria* Continuous rice *Crotalaria* Pigeon pea	Rice after *Crotalaria* clearly more vigorous and greener. Poor *Crotalaria* plot not planted till 145th March. Few plants survived. Late planted pigeon pea stand also poor.

Farmer	**Plots planted**	**Comments**
Yusufu Kayuwi	Rice following *Crotalaria* Continuous rice pigeon pea *Crotalaria*	Plots were planted in second week of February. After *Crotalaria* the rice is much greener, taller and has more tillers. Soil here looks very poor. Current plot of *Crotalaria* growing well – much larger than last year. He plans to put *Crotalaria* next season on a cassava plot where crop growth has been poor. Wants to keep own seed and expand use of *Crotalaria*.
Hamis Mwema	Rice after *Crotalaria* Continuous rice *Crotalaria*	Continuous rice here is very poor while part of area in rotation with *Crotalaria* in much more vigorous, green , tall with many tillers. *Crotalaria* plot coming into flower. Plots planted late compared to rest of farm.
Rehema Mwalaba	Rice following *Crotalaria* Continuous rice	Prior to planting *Crotalaria* last season the field had been left fallow for three years due to *Striga*. Farmer picks out that following *Crotalaria* the rice is now much more vigorous, taller and with more tillers. She reported that it was particularly green when young. Even where there is *Striga* the rice is tall and vigorous.

Sinyanga village – Kyela District		
Farmer	**Plots planted**	**Comments**
Bosco Njetile	*Crotalaria* – planted 8/3/03 Continuous rice Pigeon pea inter-crop in rice	Reasonable stand of young *Crotalaria*. Demo plots planed much later than rest of farm. Seemingly treated as a researcher plot.
Konjula village – Kyela District		
Farmer	**Plots planted**	**Comments**
Jackson Salim	*Crotalaria* inter-crop with maize Rice inter-crop with maize	An excellent plot of *Crotalaria* now flowering. Rice was late planted. These plots planted later for "research" compared to other field as farmer was not sure how good the green manure technology would turn out to be. Rice here at early tillering stage and well weeded. Many of maize plants supporting *S. forbesii*, which was also seen, scattered among rice on adjacent plot.
Philimon Mwakasege	*Crotalaria* Continuous rice	An excellent large plot of *Crotalaria* in main field. Should produce a large quantity of seed. Rice growth poor here and on adjacent fields. Plants yellow with few tillers. Patches of stunted rice infested with *S. asiatica*.
Andwele Mwakasege	*Crotalaria* Continuous rice	An excellent large plot of *Crotalaria* in main field. Should produce a large quantity of seed. Rice growth poor here and on adjacent fields. Both *Striga* species said by farmer to be at this site but none emerged as yet this season.
Robert Mwailubi	*Crotalaria* 	An excellent plot of *Crotalaria* about 14 m x 80 m in main field. Farmer observed weed suppression by *Crotalaria* and because of vigorous growth expects to have a good rice harvest next season. Also thinks land preparation will be easier after *Crotalaria* than for weedy fallow land. Rice plot here was planted late and did not survive drought.

Kiswira village – Morogoro Rural District		
Farmer	**Plots planted**	**Comments**
Oto Mzeru	*Crotalaria* planted February 8th Pigeon pea Maize	Variable stand of *Crotalaria* now seeding. Excellent pigeon pea with good population, now flowering. Maize failed due to planting at start of dry period. Plots given less priority than main field. Maize variety trial from Ilonga on adjacent plot. Could be used for maize yield estimate. A lot of *S. asiatica* on maize here.
Albertina Thomas	*Crotalaria* Pigeon pea Maize	As for Otto – plots adjacent.
George Mkami (chairman)	*Crotalaria* – planted 7/1/03 & 5/2/03 Pigeon pea	A poor stand of *Crotalaria* already incorporated. Farmers are not use to deep tillage or planting on ridges so he dug shallow trenches to incorporate pigeon pea. Prior to this he harvested a 20-litre tin of pods. Pigeon pea late planted and poor growth. Very dry poor soils away from main field.
Adolf Mawago	Pigeon pea *Crotalaria* – planted three times, failed Maize failed	Usually rice is planted on short rains from October but this year these rains failed and first showers were in January. Pigeon pea has grown well and provides excellent demo of dense planting of a pure stand. Maize and *Crotalaria* were planted prior to dry spell in late January to early February.

Kibangile village – Morogoro Rural District		
Farmer	**Plots planted**	**Comments**
Jumanne Rashid	Maize Pigeon pea *Crotalaria*	Steep slope with gravel soils. Away from main field? Last season the field was used for Sesame. Pigeon pea (0068) stand and growth excellent. *Crotalaria* a patchy stand on rocky area – now producing pods. Maize poor with much *S. asiatica*.
Pili Mohamed	Continuous rice Pigeon pea *Crotalaria*	A level site with excellent pigeon peas and *Crotalaria* stands and growth. Planted in early February after the drought period. Would be an excellent demonstration but is far from major paths and the road. Much *S. asiatica* in the rice here.
Josephine Amos	*Crotalaria* – planted 5/03/05	A steep stony site. Demo follows 2 years under cassava.. Prior to that maize

	Pigeon pea – planted 5/01/03 Maize	was grown but yield was poor due to *S. asiatica*. Pigeon pea stand is excellent and crop is now flowering. *Crotalaria* planted too late.
Filbert Mangala	Pigeon pea *Crotalaria* Rice - failed	*Crotalaria* here reasonable stand and some pods. Pigeon pea poor. Rice failed as was planted prior to drought. Low priority has been given to the plots.

Annex 2 Farmers who participated in field visits, May 2003

Kilasilo

Agrey Aliko	Asegelisye Mwasebe
Tusajigwe Isumo	Alfred Mwamndela
Albert Mwakanyasi	Kibalike Mwandenuka
H. Mwangosi	Salome Fumbo
Bosili Kalinga	Sankey Kandonga
Bernard Mwakaling	Nasse Jail Mwakatage
Saidia Mwakafyuju	M. Mwakibole
Erasto R. Mwaipopo	Oscar Mbonge
Sinyagile Nambisa	Ruth Katumsi

Itope

Laison Kayuni	Samson Mwakanyamale
Edward Mwang'onda	Yusufu Kayuwi
Hamis Mwema	Rehema Mwalaba
Asajenie Mwakitubwa	Abaallah Mbalangwe
Mwema Hamis	Christopher Mwaisabila

Sinyanga

Lusekelo Kawilo	Juma Mtawa
J. Panja	Ev. Abraham Mwamranga
Bosco Njetle	Gordon Mwakibambo
Adamsoni Njetile	

Konjula

<u>Majina ya watafiti wa kyumika</u>

Robert Mwailubi (secretary)	Jackson Salimu (Chairman)
Frank Mwaisumo	Andwele Mwakasege
Philimon Mwakasege	Jacob Mwaijobela
Twitikege Jungwa	

<u>Wasiofika</u>

S. Mwangalaba	Edson Mwaipasi
Jason Mwasege	Aden Mwakatabale
Francis Mwalyagile	

Kiswira

George Mkami	Otto Nzeru
Paul Mathew	Isdori Malini
Vincent Midongo	Aloyce Dominic
Albertina Thomas	Annamalia Paul
Felista Rocky	Germana Patrick

Phillipina Jacob	Michael Roman
Lydia John	Magdalene John
Siril Henry	Wilvina Dimosa

Kibangile

Filbert Romani	Josephina Amosy
Anjelika Alloys	Salumu Mizambwa
Salehe Ahamadi	Jumanne Rashidi
Tomasy John	Beatusy Kunambi
Pilly Mohamed	Gabriel Joseph
Salima Ally	Pita A Romani
Mizeru Mbaruku (Mwalimu)	Hamadi Durege
H Hasan (Mwalimu Mkuu)	

Farmers Exchange Visits Report

Relevance and Lessons

Project No. R8194 (ZA0511)

21^{st} – 24th May 2003

Kyela district – Mbeya region

Working Paper 4

A. M Mbwaga, and C. Massawe ARI Ilonga, Kilosa

J. Kayeke ARI Uyole (Current at SUA-Morogoro)

June 2003.

Farmers Exchange Visits Report

Relevance and Lessons

Farmers observing performance of Crotalaria before incorporation, Itope village Kyela

Preface

Striga species, the parasitic witchweeds, are wide spread in small holder crops in semi-arid and sub-tropical regions of Eastern and Southern Africa. These weeds attack and reduce the yield of maize, sorghum, upland rice and finger millet in these regions. In many areas it is the crops of resource-poor households, which are particularly affected. They impose additional stress with which farmers, who have little resources for investments in crop production, have to cope in an environment characterized by marginal rainfall for cropping and declining soil fertility.

Since 1996 staff from the Department of Agricultural Research Development, Sokoine University of Agriculture and Extension in Tanzania and, Natural Resources Institute in UK have collaborated to develop integrated Striga management practices for rice crop. Studies have been undertaken with groups of rice farmers in Kyela district, in the Southern Highlands of Tanzania.

Through on-farm trials farmers came to appreciate that *Striga* infestation and poor rice production are associated with and indicators of low soil fertility. This in turn is a consequence of continuos rice cultivation in the absence of using any fertilizer or manure. While the field trials demonstrated that up to a 60% reduction in *Striga* numbers and a 40% increase in rice yield is achieved by using urea fertilizer, farmers decided they did not wish to invest scarce cash in fertilizer. Instead they became interested in the opportunity, also observed from the field trials, to improve rice productivity on *Striga* infested soils by introducing the green manure crop *Crotalaria.*

The current project is on "*On-farm verification and promotion of green manure for enhancing upland rice productivity on Striga infested fields in Tanzania*". It is operating from October 2002 to March 2005 with aims to scale up the demonstration of using the green manure in rotation with rice in both Kyela (Mbeya Region) and Matambo (Morogoro Region).

This working paper reports on exchange visits made by farmers in villages where the project began activities in the 2003 crop season to sites in Kyela where farmer groups have been evaluating rice/green manure rotations for the past two seasons.

Further information on the project or further copies of this report are obtainable from:

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Participating Team

A. M. Mbwaga	ARI-Ilonga
J. Kayeke	ARI-Uyole (currently at SUA)
C. Massawe	ARI-Ilonga
J. Mika	ZCC-Dodoma (Video shooting)

Kyela Extension staff

A. N.Mwambungu	DALDO
M. Mwampaja	District Crop officer
H. Mwangosi	Ward Extension officer

Morogoro (Rural) Extension staff

Mrs E. Masangya	District Extension Officer
H. Kisumo	Village extension officer

Content **Page**

1. Introduction

Agricultural development worldwide is heavily dependent on effective research and dissemination of research findings. Despite extensive research outputs in Tanzania from the Agricultural Research Institutes (ARI), Universities and other colleges, little impact of some programmes has been observed at small-scale farm level. This calls for the need to re-orient research in agriculture and related fields to meet needs and aspirations of small-scale farmers who comprised about 80% of agricultural producers in the country. Any project aiming at improving agricultural research in the country for the purpose of strengthening agriculture performance at farm level must also strengthen the linkages in the dissemination of such technologies. These linkages are Farmer-Research-Extension, which comprises the system of technological dissemination or transfer.

2. Background information

The Farmer exchange visit approach, involves farmers who share a particular interest from one location visiting others elsewhere who have greater experience in managing the problem.

This approach of technology dissemination;

- Helps to promote better farming by providing an opportunity for farmers to see and discuss the best techniques with one another and with technical specialists.
- Creates a situation in which informal contracts and learning can take place
- It encourages the host farmer(s) to play a prominent role in discussing and explaining the particular technology in question.

3.Case study: "Increasing rice production on *Striga* infested land by growing green manure"

3.1 Matombo Farmer exchange visits.

Researchers and extension staff have been working with farmer groups in Itope and Kilasilo villages in Kyela to develop a low-cost approach for the management of *Striga* in upland rice for the past four years. These farmers have been evaluating the use of *Crotalaria* or pigeon pea, grown in rotation with rice, to improve soil fertility and have gained considerable knowledge and experience of how to manage the green manure. The current project facilitated farmers in four other villages, two in each of Kyela and Matombo, to begin on-farm demonstrations of rice/*Crotalaria* or rice/pigeon pea rotations in the 2003-cropping season. It is however difficult for farmers to appreciate how to grow a crop they have not previously encountered so the exchange visits were designed to provide an opportunity for the new farmer groups to learn from the experience of farmers in Itope and Kilasilo. On May 21st 2003, a total of 10 farmers from Matombo division in Morogoro rural district (5 farmers each from Kiswira and Kibangile villages) accompanied by district and village agricultural officers traveled to Kyela district. They visited demonstration sites hosted by farmers in Kilasilo and Itope on 22nd - 23rd May 2003. On the following day farmers from Konjula (7) and Sinyanga (10) in Kyela also visited the demonstration sites.

3.1.1. Objectives of the exchange visit:

- To expose participating farmers from Kiswira and Kibangile to the activities done by their fellows in Kyela district.
- To allow farmers to exchange experiences and plan for the future use of the practices they observe.
- To assist farmers to gain confidence with what they are doing in the project so that they can explain, and teach others.
- To empower farmers to think of ways to improve the technology to suit their social economic environment.

3.2.1. Matombo farmers Visit DALDO's office and Kilasilo village - Kyela:

May 22. 2003.farmers from Matombo Morogoro rural districts firstly paid a courtesy call at DALDO's office where introductions were made. The DALDO gave a brief note on agricultural activities in the district. He also advised them to take the visit as a special opportunity to learn by seeing and to be ready to practice and teach others when they returned home.

Farmers received a warm welcome from fellow farmers at Kilasilo village led by the farmer research group leader and village government chairman. After self-introductions and a welcome note the research group leader gave a brief introduction on their activities in the project. He emphasized their great challenge is to feed the growing population from the small pieces of land they have. Therefore they need to improve soil fertility to sustain continuous cultivation and to control *Striga* which is a big problem in their village. At the same time they need to reduce costs of production by using a cheap source of fertilizer and effective weeding methods in their plots. The visiting farmers then toured demonstrations from selected fields. Each host farmer explained what he/she had observed in his/her field.

1. Erasto Mwaipopo

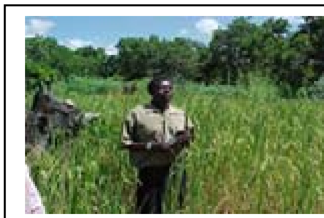
At this field the visitors saw rice grown on plots that was previously planted with pigeon pea or Crotalaria (Marejea in Kiswahili) and, plots of Crotalaria and pigeon pea ready to be planted with rice next season. Mr. Mwaipopo explained to them that by looking at the crop stand in the field he expects good rice yield because there is now no *Striga* and the fertility has been improved. Then visiting farmers asked questions

Q: What crop was on the field before pigeon pea

A: Before Pigeon pea there was cassava for four consecutive years because the area was a hot spot for Striga infestation

Q: What is the trend Striga after planting Crotalaria and Pigeon pea

A: The infestation is diminishing; there are only 2 *Striga* plants in $5m^2$


Rice after Pigeon pea

Q: What was the crop before cassava

A: The plot was followed

Q: What crop will be planted next season

A: Crotalaria/pigeon pea then rice again

Q: What is best time to plow under the green manure plants

A: At the flowering stages

Q: What crop was in the field before rice
A: There was rice highly infested with *Striga*

Q: Do you burn the mulch before cultivation
A: I plow them under because burning will take away nutrients from the mulch

Q: Do you plant by recommended spacing
A: Yes, but part of the field

Q: What kind of planting method you prefer most
A: Both planting in rows and broadcasting

Q: What is the recommended planting date for rice
A: The end of December to January but sometimes we can plant up to 15th February

Q: What are the other advantages of Crotalaria
A: It reduces frequency of weeding.

Q: How do you incorporate the Crotalaria into the soil
A: Slashing of Crotalaria is done before plowing under in the soil

Q: How do you prepare Crotalaria seed
A: After harvesting, threshing and winnowing are done

Q: Have you ever statistically compared the yield of rice in plots previously grown with
Crotalaria from those not with Crotalaria.
A: No, but with assistance from our agricultural officers we are starting this season.

2. Sankey Kandonga

He had Crotalaria and pigeon pea in his plot, next season all plots will be planted to rice and a comparison will be done of the performance of the rice with and with out rotation with a green manure.

Q: When did you plant Crotalaria and Pigeon pea?
A: Planting was done in January
Q: what is the spacing for Pigeon pea
A: 1x1m^2 to allow the canopy to cover the soil

Issues raised: It was observed that relative closer spacing of Crotalaria diminishes the growth of weeds and the need for weeding

.

3. Jail Mwakatage

He has Crotalaria, Pigeon pea and rice for comparison. Next year all plots will have rice
He explain the history of the project by pointing out that he sees Crotalaria and pigeon pea as a savior because he could not afford inorganic fertilizers and in any case sometimes they are not available.

> Q: What is the size of the plots
> A: 10 x 30m^2
>
> Q: Why do you apply ash in pigeon pea plot
> A: To prevent ants from attacking the crop

After discussion Mr. Jail gave the visitors seeds of rice variety “Mwangulu” as gift so that they can plant at their fields back home.. Mwangulu is a local rice variety known to have high tolerance to *Striga* although it has difficulties with threshability.

4. Alfred Mwamundela

In his plot he has pigeon pea (variety Mali and line ICEAP00068) and bambara groundnuts. He also showed rice grown after Crotalaria. He explained that Crotalaria, pigeon pea and bambara nuts are good for improving soil fertility and at the same time control *Striga* in the field.

> Q: When was the pigeon pea planted
> A: January 2003
>
> Q: What was the magnitude of the *Striga* problem in your field
> A: There was a lot of *Striga* but I expect that pigeon pea and bambara will reduce the problem,
>
> Q: What is your plan for next season
> A: The rice plot will be rotated with Crotalaria

5. Agrey Aliko Mwamundela

In the field there was only pigeon pea, Crotalaria and rice because this is the first year he has worked with the project. Next season all plots will be planted with rice and then rice performance and yield will be used to measure the soil fertility improvement and the trend in the number of Striga. No question was asked here.

6. Saidia Mwakafyuju

This site was different from others. It has cowpeas, Canavalia sp., pigeon pea and Crotalaria. Mr. Mwakafyuju explained that all these plants are grown for the purpose of improving soil fertility and reducing Striga infestation in the field. Next cropping season all the plots will be planted with rice. He explained that, part of the plot established with Crotalaria would not be plowed under but left to produce seed for the coming seasons.

7. Bernad Mwakalinga

He showed Crotalaria that was late planted, and rice in plots previously planted with Crotalaria. The rice was good compared to other plot that was under rice for two consecutive years,; Striga heavily infested rice on this plot. Here the visitors appreciated the benefit of Crotalaria because the attacked plot had very poor rice crop

Q: How long have you been in the project
A: Since last year

Q: What was the crop in the field prior to the *Striga* infested rice
A: The area was under cassava for four consecutive years before it was established with rice, this is the second season with rice.

Q: How many times you have had left your land fallow
A: None

Q: What is your favorite way of planting rice in your fields
A: Mostly I preferred is the use of "Kambaku" (Ox-plow for cutting furrows) because is
relative faster and more effective

8. Asegelisye Mwaseba

As the chairman of the research group he had two separate fields. One is closer to the main road, easily accessed for teaching others while the other one is a bit far where he planted his demonstration plots. The field for teaching had rice crop, Crotalaria and pigeon pea plots. All were at early stages of growth because they were planted late.

Q: Why did you plant a bit late
A: The plot was planted late because I started planting others, and this plot was the last.

Q: Plants on one side are stunted why
A: I am still investigating but I suspect the effect of tree shade or horizontal movement of water on the soil due to land gradient.

Q: Why didn't you use ash to control ants like your fellow Jail Mwakatage
A: I didn't know it but I have now learned it from my fellow Mwakatage, in the other hand I am using it for flower eater insects.

Q: How frequently farmers have come to you requesting for Crotalaria seed and advises in general
A. They have been visiting me several times and the records are kept.

The big demo plot had the following dimensions
-Rice followed Crotalaria mulch: 7x $20m^2$
-Rice followed Crotalaria ploughed under: 7x $20m^2$
-Rice after rice supplied with approximately 50 Kg Nha^{-1} :7x $20m^2$
-Rice after rice without fertilizers: 7x $20m^2$

He explained that the plots that had Crotalaria were weeded once while others were weeded twice
The plot was attractive and all visitors had a good time to judge the technology by visual assessment of the rice stand and good performance of the panicles.

Then visitors were taken to Mwaseba's other field done in collaboration with ARI-Uyole in which the visitors had an opportunity of seeing how the rice is performing in plots fertilized with urea, rice husks and burnt rice trashes.
They were also shown another parasitic weed of economic importance in lowland rice production found in Kilasilo village, known as *Ramphicarpa fistulosa*

WRAP UP SESSION
The group chairman explained a short history of the project and the research group. Initially there was an IFAD project in the area providing credit to farmers for purchase of inorganic fertilizer. Along side with this came ARI Ilonga with research on the use of urea to control Striga. The fertilizer urea rates tested were 0, 25 and 50 kg N urea/ha After the donor ceased giving us credit for purchase of inorganic fertilizer, this made us to re-think for an alternative for improvement of soil fertility and hence control of Striga. The rate of 50Kg N/ha was found to be very effective in the control of *Strig*a, but farmers involved noted that unavailability and higher price of urea fertilizer was beyond their reach. Therefore, the alternative was suggested that to use Crotalaria and pigeon pea to fertilize the soil at the same time reduce the incidence of *Striga* infestation and other weed species in the fields.

The group started with five participating farmers but today there are 26 active farmers who are participating in control of *Striga* and *Ramphicarpa fistulosa* in lowland rice. The group is aiming for much higher rice production for the betterment of its community members. They have organized themselves to form a saving and credit society namely; KIMBALU abbreviations from (Kilasilo, Mbako and Lubele, the names of sub-villages forming Kilasilo village).
Members of the research group agreed that from next season they would be assisting each other in planting operations to reduce costs and to observe proper planting dates.

Issued raised by the visiting farmers.
In the light of the observations made visiting farmers raised the following issues:

Q: Why didn't you prefer producing maize for rice supplementation
A: Maize is normally grown along the river valleys and at home gardens. Meanwhile it is off- season for its production despite the fact that is less preferred to rice.

- Farmers from Matombo division were much impressed with the effort made by their Kyela counterparts in improving their rice production through improving soil fertility by the use of green manure (Crotalaria and pigeon pea). They argued to improve rice production by improving soil fertility, reducing Striga infestation by using pigeon pea and Crotalaria.
- Village chairman was urged to make sure that the technology reaches and is practiced by other farmers who are not members of the existing Farmer Research Group for the wellbeing of the community at large. The central government was requested to support and facilitate the dissemination process of the beneficial technologies instead of leaving to the donors alone, who have already supported research trials.
- They gave an advice to their fellow farmers to establish some fruit fields. They argued that, because oil palm is doing well in the area it is better to establish coconut trees as well to increase sources of income.

Word of Thanks and Remarks

Farmers from Matombo division were happy with what they saw in the fields and they urged their fellows in Kilasilo village to keep up what they are doing and ,they called upon all those who have not joined the group to do so in order to benefit from what others are enjoying. They thanked them for their agricultural efforts, unity and hospitality showed to them. Visiting farmers promised to take the message to Matombo villagers and live on what they learned from them, with hope that in the near future they will be visited by fellow Kilasilo farmers to see what they have achieved from what they had learned there.
Then there was lunch and dances by Kilasilo farmers followed by an exchange of gifts from both groups.

3.2.2: Matombo Farmers Visit Farmer Research Group at Itope-Busale village

On the second day of their visit to Kyela farmers from Matombo visited the Itope-Busale Farmer Research Group. The tour started with a short welcome note from the host chairman, in which he called upon all guests to take their time to learn what has been prepared for them in their village. After introductions from both groups the tour began.

1. Lyson Kayuni
In his field he had Crotalaria and rice following after Crotalaria planted last season. He said that the advantages of growing rice after Crotalaria are the improvement of soil

fertility, *Striga* reduction and general weed suppression. He said that, in the plots previously planted with Crotalaria the present rice crop is vigorous and *Striga* incidence has been much reduced.

Q: Why is the growth of Crotalaria in this field is not as good as expected?
A: It was affected by drought immediately after sowing

Q: Do you have enough Crotalaria seed for the coming season in case you are not going to harvest enough from your plot?
A: Presently I don't have. I expect to request from Kilasilo villagers.

2. Samson Mwakanyamale
He is the chairman of the research group and this is his first year in the project. In his plots he had Crotalaria for seed and Crotalaria already plowed under, pigeon pea and rice each on plot sizes of 10x30m2 as agreed by the group. The crops looked good but with some shade effect on some plots because of trees around.

Q: Part of your research plot is under shade, this can not interfere with your research findings?
A: Yes, it is a mistake because this is my first time in the project, it will be shifted to another plot next season.

Q: What are your future plans
A: I will expand the area under Crotalaria so as to fertilize my field as large as I can

3. Edward Mwang'onda
He had Crotalaria and rice following after Crotalaria. The crop was good. He explained that the plot planted with rice after Crotalaria was weeded only once compared to the rest {which were weeded at least twice). His future plans are to scale up the area under Crotalaria.
Q: What was crop growth like before you started rotating with Crotalaria?
A: Earlier the crop was good but with time the soil fertility started dropping and *Striga* started coming up but after Crotalaria the crop is good and next season I will expand the area under Crotalaria.

Q: What was the indigenous control measure for Striga?
A: An infected field was put under cassava production for 3-4 years before return to rice. After *Striga* appeared rice mono cropping is not advised

Q: Was *Striga* a problem in your field some years ago
A: No, the incidence is of recent because fertility is declining
Q: When did you first hear of "Kyumika" (*Striga*)
A: Early 1988

4. Yosufu Kayui
His demo plot was away from the main field of rice and it was planted very late. The general performance of the crop was poor. The farmer was not there to explain. This was an example of a poor demonstration plot.

5. Rehema Mwalaba
She showed rice grown after Crotalaria. It was a good crop

Q: What was the yield before Crotalaria
A: Estimated 3 bags per acre

Q: What are the future plans
A: To expand the area under Crotalaria

Then farmers were taken to see the plot belongs to Mwema's wife which was highly infested by *Striga asiatica*

6. Asajenye Mwakitubwa
He has Crotalaria and rice after Crotalaria. There was no question; the plots were very good.

WRAP UP SESSION
There was speech of thanks from Matombo farmers promising to put all they had learnt from the visit into practice. They also called upon all people who haven't yet joined the project to do so immediately because they are lagging behind. Agriculture officers who accompanied the visiting farmers emphasized on the practical employment of the technology into their fields in Matombo and called other farmers so that the technology can have a wide spread. Then there was luncheon prepared by the hosts

GENERAL OBSERVATIONS
1. Farmers were confident on what they were doing because they were bold enough to explain themselves and answer fully all questions raised by their fellow farmers.

2. The size of their experiment/demonstration plots was big enough for practical assessment of the technology.

2. Most of the demonstration plots were situated in their main fields making it easy for farmers to attend the demos while attending their main field. This will make it easy to practice the technology in whole of the main field

Lessons Learned
From the visits farmers learned the following
- Strong farmer, research and extension linkage enhances technology transfer
- Better management of soil fertility through use of green manure can improve crop (rice) yields and minimize the problem of *Striga*.

- The importance of keeping records in order to be able to evaluate success and failures of agricultural activities
- The importance of farmers organizations in accessing and owning technologies
- The importance of research institutions in enhancing agricultural development

LIST OF PARTICIPANTS

1. Dr. A. Mbwaga	ARI-Ilonga
2. C. Massawe	ARI-Ilonga
3.Mrs E.Masangya	District Agriculture Office Morogoro
4. H. Kisumo	DVEO Matombo
5. J Kayeke	ARI Uyole (currently at SUA)
6. M. Mwampaja	District Agriculture Office Kyela
7. H. Mwangosi	DVEO Kyela
8.A. Mwaseba	Group Chairman- Kilasilo FRG
9.Nancy Mgogo	“Member of FRG” Kilasilo
10. Bernard Mwakalinga	“Member of FRG
11. Albert Mwakanyasi	“Member of FRG
12. Alfred Mwamundela	“Member of FRG
13. Sinyangile Nambisa	“Member of FRG
14. Petter Fumbo	“Member of FRG
15. Saidia Mwakafyuju	“Member of FRG
16. Ester Kubali	“Member of FRG
17. Bosili Kalinga	“Member of FRG
18. Erasto Mwaipopo	“Member of FRG
19. Aggrey Aliko	Vice chairman Research group Kilasilo
20. Oscar Mbonge	Chairman Village Government
21. Tusajigwe Isumo	Member FRG Kilasilo village
22. Flora Samwiro	“Member of FRG
23.Kabatika Mwandenuka	“Member of FRG
24.Sinae Kajila	“Member of FRG
25. Salome Fumbo	“Member of FRG
26. Njoka Mwakalago	“Member of FRG
27. George Mkami	(Chairman) Matombo
28. Adolf Mawango	“ Member of FRG Matombo (Secretary)
29. Albertina Thomas	“Member of FRG Matombo
30 Germana Peter	“Member of FRG Matombo
31. Paulo Matayo	“Member of FRG Matombo
32. Filbert Roman	Member FRG Matombo (Chairman)
33. Josephina Amos	“Member Matombo FRG (Secretary)
34. Pili Mohamed	“Member Matombo FRG
35. Jumanne Rashid	“Member of FRG
36. Anjelika Alois	“Member of FRG

3.3.Sinyanga and Konjula(Njugilo) farmers exchange visit to Kilasilo and Itope -Busale villages:

3.3.1 Visit to Farmer Research Group Kilasilo village

Farmers from Sinyanga and Konjula (Njugilo) are growing Crotalaria and pigeon pea for the first time this season and so were brought on the exchange visit to see what their fellow farmers are doing. The Farmer Research Group Chairman Mr. Mwaseba gave a brief welcoming note and introduction before farmers proceeded to the fields.

1. Asegelisye Mwaseba
He has two separate plots one is close to the main road he said this is for teaching others while the other one is away where he planted his demonstrations. The plot near main road had Rice, Crotalaria and pigeon pea all were planted late as they were found in their early stages of growth.

His main demonstration plots had

- Rice followed Crotalaria mulch: 7x $20m^2$
- Rice followed Crotalaria plowed under: 7x $20m^2$
- Rice after rice supplied with 50 Kg Nha^{-1} :7x $20m^2$
- Rice after rice without fertilizers: 7x $20m^2$

He explained the plots that had Crotalaria were weeded once while others were weeded twice
The plot was attractive and all visitors had a good opportunity to judge the technology by visual assessment of the rice stand

Q: What do you do with the Crotalaria in your field
A: After reaching flowering stage I slash/cut it and then plow under

Q: Are the Crotalaria stalks contributing to the fertility of the soil
A: Yes therefore after threshing seeds the stalks are returned to the field because they also contribute to the soil fertility.

Q: How was the stand of rice before Crotalaria
A: The rice crop was poor because of low soil fertility and a high *Striga* infestation. Therefore Crotalaria had increased soil fertility and reduced *Striga* infestation.

Q: Is it important to plant by seeding in rows?
A: Not necessarily, you can broadcast as well, though broadcasting is simple but more seed is used compared to when planting is done by planting in rows

Q: What if we burn the sticks
A: Fertility will be lost

Q: When to plant Crotalaria
A: It is important to observe planting dates of rice crop, that is the best time for planting Crotalaria

Q: What is the logic of having plots of Crotalaria incorporated and others not incorporated
A: To have comparison in yield. How much do I loose for not incorporating Crotalaria in plots that are reserved for seed

3. Alfred Mwamundela (The farmer was absent therefore his brother, also a participating farmer , gave the explanation)

In his plot there were pigeon pea (varieties 00040 and 00068) and bambara nuts. Visiting farmers were also shown rice grown after Crotalaria. They were told that Crotalaria, pigeon pea and bambara nuts are good in improving soil fertility and at the same time are effective in *Striga* control.

3. Aggrey Aliko Mwamundela

This is his first year of trying to improve rice production so in his field there was pigeon pea, Crotalaria and rice.. Next season all plots will be planted with rice and then rice yield performance and number of *Striga* will be used to reflect the efficiency of green manure in soil fertilization. No question was asked here.

4. Saidia Mwakafyuju

This site was different from others that it had cowpeas, Canavallia sp. pigeon pea and Crotalaria. He explained that all these plant are grown for the purpose of improving soil fertility and reducing *Striga* infestation in the field. Next cropping season all the plots will be planted with rice.

Q: What is the size of the individual plots
A: All are $10x30m^2$ as agreed during preparation meetings

Q: What amount of Crotalaria seed was used in the plot
A: Only 1kg as given to other farmers

Q: How was Crotalaria planted
A: Land preparation was done then broadcasting followed, without covering the seed

Q: What was the aim of establishing cowpea in the field
A: They are mainly for food and soil fertility improvement

5. Jail Mwakatage

He has Crotalaria pigeon pea and rice for comparison. Next season all plots will have rice He explain the history of the project by pointing out that he sees Crotalaria and pigeon pea as a savior because he couldn't afford inorganic fertilizers and sometimes they are not available.
No questions were asked here.

6. Erasto Mwaipopo

At his plot visitors saw rice after pigeon pea, rice after Crotalaria and a plot which has Crotalaria and pigeon pea ready for next season. He explained to them that from the stand and crop vigor he expects a good rice yield because there is no *Striga* this season and the fertility has been improved

Q: What are you going to do with Crotalaria seed
A: I will sell seed after satisfying my needs

Q: In future what kind of crop will you prefer most in your fields, Crotalaria or pigeon pea
A: I will use both of them

Q: We are very impressed with your work and field results at large, but my concern is where to get seed for green manure crops
A: Good source is from your neighbors within and outside your village

WRAP UP SESSION

The group chairman explained a short history of the project and the research group. The research on Striga control started by using Urea fertilizer 50kg N/ha and 25kg N/ha. 50Kg N/ha was very effective in the control of Striga but farmers noted that unavailability and higher price of fertilizer Urea was beyond the reach of majority of small-scale farmers. Therefore the best alternative was to use Crotalaria and pigeon pea to fertilize the soil at the same time reduce *Striga* infestation and intensity of other weeds in their fields.

The group started with five participating farmers but today there are 26 farmers who participate in control of *Striga* and *Ramphicarpa fistulosa* another parasitic weed found in lowland rice in their village. The group has been organized to form a credit society namely KIMBALU(Kilasilo, Mbako and Lubele the names of sub-villages forming Kilasilo village)

Future plans in rice production

1.They will improve rice production by improving soil fertility, reducing *Striga* infestation by using pigeon pea and Crotalaria

2.They will be assisting each other in planting operations to reduce costs and they will observe proper planting dates.

3.3..2. Visit to Farmer Research Group at Itope-Busale village

Then the visiting team started off to Itope Busale, the tour started with a short welcome note from the host chairman. After Introduction of both farmer groups the tour began.

1. Lyson Kayuni
In his plot he has Crotalaria and rice after Crotalaria. He said that the advantages of growing rice after Crotalaria are improvement of soil fertility, *Striga* reduction and weed suppression.

Q: Why the Crotalaria in the field are not as good as they are supposed to be
A: They were affected by draught immediately after planting

2. Samson Mwakanyamale (Chairman of the Group)

He is the chairman of the research group although this was his first year in the project. In his plots he has Crotalaria for seed and Crotalaria already plowed under, pigeon pea and rice plots each by the size of $10x30m^2$ as agreed by the group. The crop was good though shade from the near trees has some negative effect in parts of the plots.

Q: Why did you locate the research trial where there is shade
A: It is a mistake because this is my first time in the project

Q: What are your future plans
A: I will expand the area under Crotalaria so as to fertilize my field as much as I can

3. Asajenye Mwakitubwa
He has Crotalaria and rice after Crotalaria. There was no question, the plots were very good.

WRAP UP SESSION
All farmers sat together and evaluated their tour. Visiting farmers appreciated what they saw and they promised to use what they had learnt in their own fields.. They also promised to explain what they had observed to all those who didn't have a chance to participate in this exchange visit. They were also allowed to make exchange visits, because the *Striga* research has built a bridge that was not there before this trip.

List of participants

Konjula (Njugilo) village

1. Andrea Mwakasege
2. Jacob Mwaijobele
3. Aden Mwakatabale
4. Twitikege Jungwa
5. Jackson Salim
6. Frank Mwaisumo
7. Francis Mwalyagile

Sinyanga Village

1. Luskelo Kawilo
2. Asajinie Mtawa
3. Labson Mwankimba
4. Andwele Mwalukimba
5. Juma Mtawa
6. Franka Panja
7. Bosco Njetile
8 Ezron Mwaijambo
9. Henry Simfukwe
10.White Mwansasu

Itope village

1. Samson Mwakanyamale
2. EdwardMwang'onda
3. Abdallah Mbalangwe
4. Lyson Kajuni
5. Asajenye Mwakitubwa
6. Goodluck Masebo
7. Reheme Mwalaba
8. A. Andendekisya Mwantwango
9. Oden Simtowe
10. Yusufu Kayui
11. Mwema Hamis
12. Hamis Mwema
13. Jim Mwakibinga
14. Gideon Mwang'onda
15. Christopher Mwaisabila
16. Amulike Mbukwa
17. Saada Mwema
18. Theresia Christopher
19. Mama Hamis
20. Mama Kayui

Annex 1
Farmer Research Group report from Kiswira on their visit to Kyela district, Mbeya region

On May 21st 2003 a total of 10 farmers, five each from Kiswira and Kibangile Farmer Research Groups (FRG) in Matombo division in Morogoro rural district, made a visit together to Mbeya region to study witch weed (*Striga*) control.

Farmers from Kiswira village were;
1.George Mkami…………….Chairman of the group
2. Adolph Mawango…………Secretary of the group
3. Albertina Thomas
4. Paul Mathew
5. Germana Peter

These are representative of the 18 members of the Kiswira Farmer Research Group. Ward Agricultural Extension Officer Mr. H. Kisumo, accompanied by Mrs E. Masangya Subject Mater Specialist from the district agricultural office, Morogoro, led the delegation.

Purpose of the visit
1. We as researching farmers, we were eager to learn from our counter parts farmers in Kyela how green manure can improve soil fertility and diminish the incidence of witchweed (*Striga*) in rice plots and hence improve rice yield.
2. To learn about the usefulness of pigeonpea varieties (ICEAP 00040 "Mali" and 00068) on soil fertility improvement and in management of *Striga* problem
3. To get acquainted with agricultural achievements already attained by our fellows in Kyela district following the practice of growing green manure in their fields.
4. To assess their readiness of recommended practices in agricultural production of rice.
5. To get acquainted with the witchweed species found in their locality, to see if these are the same species found in Matombo and the extent damage to the crop.

Visit to Kilasilo village
On 22nd May 2003 we arrived in Kyela district in Mbeya region, Dr. Mbwaga facilitated our travel to Kilasilo village to meet our hosts. 14 farmers welcomed us.

Names of farmers whom we visited are:
1. Erasto Mwaipopo
2. Esnati Kandonga
3. Jail Mwakatage.
4. Alfred Mwamundela
5. Saidia Mwakafyuju
6. Bernard Mwakalinga
7. Asegelisye Mwaseba

The visited farms were divided into three small plots for research activities as follow:

Plot 1: The plot was planted with Crotalaria previous season (2002) and planted with rice crop this season (2003)
Plot 2: The plot was planted with pigeonpea (ICEAP 00040 “mali” and ICEAP 00068) and planted with rice crop this season (2003)

Plot3: The plot was planted with rice in both two seasons (2002 and 2003)

Observations made from respective plots

Plot 1

- The crop establishment was excellent
- We were informed that *Striga* incidence was much reduced
- Weeding frequency was reduced from three to one
- Soil was looking fertile, loamy and relatively moist

Plot 2

- The crop establishment was excellent
- We were informed that *Striga* incidence was much reduced
- Weeding frequency was reduced from three to one
- Soil was looking fertile, loamy and relatively moist

Plot 3:

- The crop vigor was relatively weak
- The *Striga* incidence was observed to be high
- The plot was weeded twice
- Soil was observed to be less fertile

Visit to Itope village
On 23rd May 2003 we visited Itope village where we met 22 host farmers waiting after our arrival.

Names of farmers whom we visited their fields are:
1. Lyson Kayuni
2. Samson Mwakanyamale
3. Edward Mwang’onda
4. Yosufu Kayui
5. Rehema Mwalaba
6. Asajenye Mwakitubwa

These farmers are carrying out activities similar to those of their counterparts at Kilasilo village and have divided their fields into three small plots for research with the same crops planted.
Results from individual farmer’s fields resemble that observed in Kilasilo regarding the effects of Crotalaria, pigeonpea in improving soil fertility and management of *Striga*.

Lesson learned by Kiswira farmers from Kilasilo and Itope village's visits

1. We have learned that Crotalaria is very important in increasing soil fertility and hence for the control of *Striga*
2. We have appreciated efforts by Extension agents in the area on awakening farmers on the importance of green manure in line with pros and cons of uses of chemical fertilizers
3. We have learned that self-creativity is important for agricultural development
4. We have understood that agricultural experts are working for our well being but not for the sake of their personal interests.

The agreed way forward after our visit to Kyela:

- To establish strategies to ensure that the knowledge gained reach every member of our research group and eventually every member of our village for the betterment of the entire community.
- To ensure that the knowledge obtained reach majority of our community, we shall look for assistance from religious institution in the village for technical and material support
- The group will establish means of becoming economically viable by selling the share of ownership of the group to any member interested.
- The present strategies is to raise the present level of production from 2 – 10 bags of rice per acre

Farmers' opinions

- They have requested agricultural experts to use seminars for delivering new information/technology to their clients
- There is a request to Government and research institutions to assist some members from Farmer research group to attend agricultural shows and other events to learn agricultural improvement related approaches.

Annex 2
Report from Farmer Research Group from Kibangile village Matombo-Morogoro rural district:

Introduction
Our journey to Kyela district in Mbeya region for a learning visit started in Morogoro on May 21st 2003. We were accompanied together by Ward Extension Officer, Mr. H. A. Kisumo and Mrs E. Masangya,, a matter specialist from agricultural district office of Morogoro rural district. We arrived in Kyela at 17^{00}hrs, met by Dr. Mbwaga at the bus stand Kyela.

Objective of our visit
To see and learned from our counterpart in Kyela the way they are using green manure in the management of both soil fertility and witchweed (Striga) problem
Our team was compost of
1. Filbert Roman……………….. Chairman of the group
2. Josephine Amos………………….Secretary of the group
3. Pilli Mohamed
4. Jumanne Rashid
5. Angelika Alois

On 22nd May 2003 we visited Kilasilo village where our hosts warmly received us. After introductory remarks we started visiting different well-established research plots.
The following day, 23rd May 2003, we visited Itope village. Where we got a similar introduction to each other followed by visiting the research demonstration field plots

Knowledge gained from Kilasilo and Itope village visits

- We acknowledged that Crotalaria and pigeonpea are very useful in the improvement of soil fertility. This became obvious in plots, which were under green manure last season and this season planted with rice there was good rice crop stand compared to those under continuo rice.
- Striga incidence was observed to be very low almost zero in plots previously established with green manure
- Weeding frequency was reduced from three to one in plots under green manure.

The agreed way forward after a visit

After returning home, we will improve the way we conduct activities in our research plots. Also we are obligated to disseminate the technology for improving soil fertility and management of *Striga* through use of green manure to all members of the community

Journey back home
We traveled back to Matombo on 24th May 2003. The journey was safe and enjoyable

Acknowledgement
We are indebted to Dr. A. Mbwaga, the coordinator of the farmer exchange visit who facilitated us to pay a visit and learn from our fellow's farmers in Kyela district

Annex 3
Report by Ward Extension Officer about Matombo Farmers' exchange visit to Kyela district, Mbeya region

Contents

1.0 Introduction

- Project on improvement of soil fertility and management of *Striga* problem on rice, sorghum and maize crops is being conducted in the village by researchers from ARI- Ilonga.
- Under the project activities, exchange visits involving farmers, extension agents and researchers have been conducted in Morogoro, Tanga, Dodoma and Mbeya regions with the aim of exposing them to different technologies at different environments.
- In May 2003, farmers from Kibangile and Kiswira villages in Matombo division in Morogoro rural district (list of farmers attached) made a visit to Kyela district in Mbeya region to learn by seeing on activities carried by their partners in relation to soil fertility improvement
- Farmers who were selected for a visit were those owning fields with poor soil fertility and with high *Striga* infestation.
- Villages visited was Kilasilo and Itope both in Kyela district
- The delegation consisted of 10 farmers (5 women and 5 men) accompanied by Extension agent and district agricultural officer from Morogoro rural. In general the visit was successful because farmers learned much from their fellow farmers.

2.0 Rice fields

2.1 Crotalaria

- Farmers with assistance from Dr. Mbwaga from ARI – Ilonga formed a Farmer Research Group to fight against diminishing soil fertility status together with increasing *Striga* problem

- Initially farmers in Kyela were using chemical fertilizer (Urea) for management of soil fertility but it was not affordable by many farmers due to high costs of fertilizer.
- In turns, Dr. Mbwaga introduced the option of use of Crotalaria in place of Urea fertilizer
- The outcome of that option is very obvious in farmers' fields during our visit. In plots previously established with Crotalaria and pigeonpea and later planted with rice this season, the crop looked vigorous and incidence of *Striga* was much reduced. This made farmer evident on the advantages of the that technology
-

2.2 Pigeon pea

Two pigeonpea varieties ICEAP 00040 "mali" and ICEAP 00068 were planted in farmers plots to improve soil fertility. Rice crop grown after pigeonpea had good performance as was observed on rice plots previously planted with Crotalaria.

Advantages of Crotalaria

(i) It improves soil fertility
(ii) It reduces number of weeding
(iii) It is economically cheaper to chemical fertilizers

Advantages of pigeon pea (Mbaazi)

(i) It is a common food for human beings
(ii) It performs the same function as that of Crotalaria

2.3 Farmers fields

- Most of the fields visited are monocropped with rice
- Common method for their land preparation is the use oxen drawn implements
- We noted that farmers follow recommended practices in agriculture from planting to harvesting time.
- Their main cash crops are rice and cocoa.

3.0 Learning from the visit

3.1 What they learned

- How to establish Crotalaria
- The use of oxen drawn implements
- How Crotalaria increases rice yield
- The importance of establishment of Framer Research Groups
- The technique of dividing the field into two portions, one established with
- green manure and another established with rice in rotation

3.2 What was agreed way forward?

To produce enough Crotalaria seed for the coming field trials/demonstrations

To broaden the knowledge of use of Crotalaria for fertility improvement to the rest of community members

To motivate and assist farmers on the use of Crotalaria

To urge farmers to establish good green manure plots in a competitive manner to beat what their fellow farmers in Kyela have achieved

4.0 Opinions from Matombo farmer research groups:

4.1 Participating farmers admitted that despite being rice producers for a long time, of late they have come to learn improved methods of production especially on:

- Reducing *Striga* incidence by improving soil fertility level
- General management of rice fields
- Selection of good quality seed
- Better preparation of land for rice production

4.2 Kilasilo farmers

Kilasilo farmers explained importance of having farmers research groups and having an account in the bank

4.3 Itope farmers

Farmers in Itope village explained the importance of farmer groups for sustainable agricultural development

Annex 4: Field Day at Kilasilo Village

A.N.A. Mwambungu
DALDO Kyela District

Objectives of the field Day:

1. To create awareness on the use of Crotalaria to large number of farmers
2. To introduce to villagers the importance of using Crotalaria (Marejea) in paddy fields as alternative strategy for control of Striga and increasing soil fertility
3. To educate a large number of resource poor farmers living in Kilasilo to see that the problem they encounter in their upland rice production has got a solution within their easy reach.
4. To show to resource poor farmers that the use of Marejea or pigeon pea in rotation with upland rice will increase soil fertility and reduce Striga incidence.

Field Day:-Day 1: 30th May 2003:
The field day was initially planned to be carried out on 30th May 2003, but it was not done because in the village a prominent person died in the village. The field day was then postponed to 2nd June 2003

Field Day: Day 2 June .02.03
The following people from the district attended and these included

District Commissioner of Kyela district
District Executive Director of Kyela district
15 District Department Heads
District Council Chairman
40 Village farmers
6 Farmer Research Group members, who facilitated the field tour
5 Farmers from Jinai village attended
3 District councilors

Farmers from Sinyanga and Konjula villages failed to attend for various reasons.

Site for Demonstration:
The field of Farmer Research group member Mr. Saidia Mwakafyuju was used as center for demonstration. The following crops were observed and explained to the visitors by the FRG members

The use of Marejea to increase soil fertility and control of Striga
The use of pigeon pea in crop rotation with rice for control of Striga and increase of soil fertility.

The farmer research group members explained to their visitors that Striga or Kyumika (in Kinyakyusa) was a real problem in their fields. They noted with concern that the problem of Kyumika becomes magnified when there is low soil fertility and less rainfall during the season. They also appreciated the achievement reached by their fellow research farmers in combating Striga. Majority of the visitors promised to participate in the next cropping season.

Collaboration:
The field day was made possible by the help of Ilonga Research Institute – Dr Mbwaga who provided us with 150 000 Tzsh, for management of the field day successfully. The district appreciated this contribution with thanks.

II: **FARMERS EXCHANGE VISITS**

Kyela Farmers visit Matombo

Background information:

The farmers exchange visit approach is used for the purpose to educating farmers by seeing, sharing information and experiences in solving a common problem. The visit is done so that farmers with little experience to learn from those with long experience of solving the problem or farmers to appreciate what others are doing. In addition, the experienced farmers can visit non-experienced to motivate their fellow and learning other interesting experiences. The Exchange visits enable farmers

- To have an informal interaction where Ideas, problems and success can be discussed
- To have a have farmers themselves create confidence on what they are practicing in their farms.
- To encourage farmers creativity in solving the problem

Kyela Farmers exchange visit

Kilasilo and Itope villages in Kyela District have been under a research to develop a low cost approach in the management of Striga for four years. Some technologies have been tested and proven to be efficient, but farmers decided to practice the use of Crotalaria and pigeon pea fallow because these are easy to practice, cheaper and environmental acceptable. On 21st May 2003, 10 farmers from Mororgoro rural visited Kyela farmers to learn the use of Crotalaria and pigeon pea in the control of Striga in their maize and rice farms. Five farmers from each village Kibangile and Kiswira represented. On 26th May 2004, a follow up visit was done by 10 farmers from Kyela district. This was meant to see what Morogoro farmers are doing after they have learned the technology from Kyela farmers. Five farmers from each of the villages Kilasilo and Itope accompanied by 2 Extension Officers visited Morogoro rural, at Kiswira and Kibangile villages.

Objectives of the exchange visit

To share experiences on improving soil fertility and reduction of the impact of Striga on the cereal crop after growing green manure.

Activities

1. The morning of 27th May 2004, Kyela farmers paid a courtesy call to a District Agriculture Office in Morogoro. The District Extension Officer was there to welcome farmers. He thanked them for sparing all other activities to come and visit their fellow farmers in Morogoro. She requested them to value the trip and make use of it for the betterment of the agriculture production in their farms. She wished them a nice trip and a good stay in Morogoro. After that short welcome note the farmers traveled to Kiswira village accompanied by one official from Morogoro Agriculture District Office.

2. Farmers arrived at Kiswira village; they were welcomed by their fellow farmers accompanied by the Ward Extension Officer, the Ward Executive officer and the village Government leader. The Village Government leader gave a short welcome note. Introduction was carried out to all participants on the visit including the research team.

3. Selected fields were visited

3.1.Constantine Antoni Lukoa
The plot is planted Crotolaria, pigeon pea and maize TMV 1 variety for the first year. All plots were planted on 20th March 2004. The plot is close to the main road so as passer by can see the field. Generally, the plots are good. The farmer confidently explained what he is doing in the trial to the visitors.

Q: Were you asked by other villagers about the trial
A: Yes big number of people asked about the trial

Q: Why the fertility of your field is so low while you said this was your first year to cultivate this are.
A: The field has been under continuos cultivation but it is my first time to cultivate this field

Q: The slope of your plot shows the possibility of soil erosion, what are you going to solve the problem of soil erosion
A: I will use terraces

* *A course on water harvesting and soil conservation will be taught later*

Q: Are there Striga in your plot
A: No up to now there is no Striga in my plot

Q: Have you see any benefit to grow Crotolaria
A: Since this is the first year therefore, the benefit of crotolaria is not yet to be seen

Q: Where is the plot for seed
A: Since the demand for seed is high therefore the whole plot will be left for seed

3.2 Albertina Thomas
There were two plots one was under maize after the Crotolaria and pigeon pea while another was under Crotolaria and pigeon pea for the first season. The first plot that was under maize after crotolaria and pigeon pea had poor maize in the control plot. On the other hand maize after crotolaria was better than maize after pigeon pea. The plot was good showing the results of the technology and the farmers gave good information on what se has been doing since last season.

Q: Why the size of plot is that much small

A: The plots are so small because are meant for research and teaching others farmers, but next year the plots will be larger than this season.

Q: Why are there two plots of crotolaria
A: The other plot belongs to another farmer

Suggestion:
In order to solve the problem of the slope furrow must be made across the slope. It is hard to make furrows but deliberate efforts must be employed to solve the soil from erosion.

3.3 Otto Mzeru

The plot had maize Crotolaria and Pigeon pea in the first year. The trial was planted on 6th February 2004. The plot size was 15 x 10. He explained that crotolaria and pigeon pea were planted to solve the problem of low soil fertility and Striga infestation. He also showed the plot that had crotolaria and pigeon pea last season. Plots that were under crotolaria had health stalks than the one under pigeon pea.

Q: Why do you repeat the experiment.
A: The idea is to get good results since last season the experiment was affected by poor weather.

Q: The plots that had crotolaria last season had some Striga
A: The population of crotolaria was very poor.

3.4 George Mkami
The experiment was planted on 6th of February 2004, there is maize pigeon pea and Crotolaria (Plot size 15x10). Last season pigeon pea and Crotolaria performed poorly because of weather, this season all the plots are doing fine. In addition, there is another plot that was grown a cover crop (Pueraria spp locally called Klaka from the name Clerk) which farmers decided to investigate. The observed that this plant has a very slow germination. He sow seeds on January but germination was observed on April.

Q: Why do you have a plot for Pueraria spp
A: I am investigating its ability to fertilize the soil and suppress weeds in the field.

Q: Crotolaria has reached a stage to being plowed under, when are you going to plow under
A: I left it for teaching purposes otherwise I would have plowed under.

Q: Did your neighbours show an interest on the technology
A: Yes a lot of them some have collected Crotolaria seed although they are not research group members.

Q: How did you know the spacing of maize
A: It is normally written on the bag

Q: What is the spacing for pigeon pea
A: 1 x 1 m^2

Q: What are you going to do next season
A: All plots will be under maize in order to compare the performance of the crop

Suggestion:
Cut down the palm trees because they dry up the soil.
Don't delay planting operation to ensure that the fertility enhanced is utilised immediately to avoid loss due to slope of your plot.

3.5.Germana Peter
The plot was under maize pigeon pea and Crotolaria all performing well the plot is situated close to the foot path so that who are passing by can learn. The farmers had problem in addressing herself therefore, the fellow farmers assisted her.
Q: What variety of pigeon pea have you planted
A: Mali

Q: How will you teach other farmers
A: Some comes to my home some are met on the way
Suggestion:
It is important to have a poster that will be informative enough to assist other farmers

3.6 Lydia John
Her plot has Crotolaria pigeon pea and maize all planted on the 6th February. All the plots are doing fine.

Q: Why did you plant Crotolaria and pigeon pea
A: These were planted to fertilize soil and control Striga

Q: Why all plots were planted on 6th February
A: That was the advice from the Extension officer

Then the showed the visiting farmers Mwangulu rice which was obtained in Kyela. The plot was first attacked by the army worms.

3.7 Henry Sirili

This is the first year. Pigeon pea and crotolaria were planted on the 4th March, maize was planted 10th March

Q: Why planting crotolaria and pigeon pea
A: To improve soil fertility and control Striga

Q: What are you going to do next season

A: All plots will be planted maize to compare the performance after maize.

Q: How will you compare the yield
A: By weighing the yield obtained

Q: What are your future plans
A: To extend the technology to a large area.

Q: Do you have a plot with Striga
A: Yes that is where the extension of the technology will be done

3.8 Antonia Antony
She failed to continue with the trial because of ill health.

3.9 Paul Matei Somvi
He has Crotolaria, pigeon pea and maize all were planted on 26th Mrch 2004

Q: Why did you participate in this research group
A: To manage Striga though soil fertilization

Q: Why didn't you use other sources of fertilisers like animal manure
A: Crotolaria and pigeon pea are the cheapest source of fertilizer

Q: What are you going to do next
A: Test by growing maize in all plots

3.10 Daudi Mdachi
He has Crotolaria, pigeon pea and maize all were planted on 10th of February. The plot of pigeon pea was intercropped with maize. The plot of maize was already harvested.

Q: Why did you practiced inter cropping
A: To make use of the open spaces between pigeon pea

Q: Where did you get the idea
A: I was advised by the Extension officer

Q: How was the yield of maize
A: Very poor because of poor soil fertility and Striga infestation

Suggestion:
He was advised to increase the size of the Crotolaria plot. In addition, the position of the plot being close to the church was an advantage for technology dissemination. Therefore, he was advised to make use of it.

Wrap up
The host farmers gave the history of their research group (appendix)

The visiting farmers congratulated their fellows for job well done. They appreciated that what was taught in Kyela is now in practice. They also appreciated the way the Kiswira farmers were conversant and confident on whatever they did in their plots.
Kiswira farmers were advised to assist other farmers in case of problems so that the development will be for the whole group up to the village level. In addition, Kiswira farmers were challenged to improve the size of the plots in order to move to another stage of adoption.

Since the research group is expected to cater for other social activity in the village then the establishment of the Credit society was highly praised as a good start towards poverty alleviation.

The Ward Executive Officer apologized for having a long programme. On the other hand she commended the job done and suggested the extension of the technology to other villages, because about 33 villages are infested with Striga

Visiting farmers and their host and other guests had a meal and drinks together, there was exchange of gifts among farmer groups. The hosts showed a drama which encourage farmers to use scientific measures instead of wrong beliefs to control Striga in their fields

4.0 Kyela farmers visiting Kibangile village

On 28th May 2004 Kyela farmers visited Kibangile village.
They were welcomed by the host farmers, after introduction farmers and accompanied by the research team started the tour. The field had two spp .of Striga, S. asiatica and S. forbesii. Maize was intercropped with maize but plant population was poor in addition, maize was sown later after pigeon pea had grown high.

4.1 Anjelica Aloys

This is the first year of the experiment. The trial was planted on 26th February 2004. There is pigeon pea, Crotolaria and rice. The farmer explained what he has done.

Q: Why did you plant late
A: There was a problem of obtaining seed

Q: What is the idea of using the technology
A: To improve soil fertility and control Striga

Q: Why the crotolaria is not yet plowed under
A: The intention is to obtain seed

4.2 Filbert Roman

He had two plots one was on the second season while the other was on the first season. That of second season is all under Mwangulu rice, the area that had crotolaria was good followed by the plots which were under pigeon pea and rice after rice was poor. The treatments were obvious. This season there is Crotolaria, pigeon pea and rice, these were planted 16th March 2004. The plot size is 7 x $41m^2$. The plots are good, the situated along the foot path. On each plot there was a poster which can assist whoever passing by to read and understand what is done there. The posters were very informative hence, no question were asked, they attracted visiting farmers who promised to practice them in their field next season.

4.3 Abdul Ally

This is his first year, he has maize crotolaria and pigeon pea. Maize stand was poor because he replanted after the first crop dried because of draught and the spacing was poor. The plots were very small.

Q: Why are your plots so small
A: Admitted the mistake in the first year of the trial

Q: Where did you get the information of the technology
A: The Extension officer

Q: What variety of maize have you planted in the trial
A: Local variety

4.4 Josephina Amos
The trial was planted on 3rd March 2004 it has pigeon pea, Crotolaria and rice. The plots are large and the crop is doing fine.

Q: What is the improvement in the yield
A: The yield has improved by 50%

4.5 Halima Ramadhani

The plots were planted on 6th January 2004. The plot size was large. Farmers appreciated. The performance of the trial.

4.6 Hadija Salum
The trial was planted on 9th February, it has pigeon pea, Crotolaria and rice. Plots are and impressive

Q: What is the plot size
A: 16 X 5 m^2

Q: What is the variety of pigeon pea grown
A: The variety of P(0040)

4.7 Kibangile Primary Scool
The plot is managed by the Primary School where pupils of Class 5 – 7 are taking part. The trial is doing fine.

Q: What is the spacing of pigeon pea
A: $1x1m^2$ but the space is so large neext time intercropping will be done to utilize the space

Q: Is there a plot for seed multiplication
A: Yes

Wrap up and closing session

After the field visit, farmers were entertained by pupils. They had prepared Choir and poems which calling farmers to put together their efforts to curb the problem of Striga in order to improve their well being as a strategy in poverty alleviation.

The group chairman from Kyela praised their fellow farmer for commendable job they have done. It shows that the knowledge obtained during their visit Kyela is now in practice. He argued them to increase the size of their plots to enjoy the benefit of using Crotolaria and pigeon pea in their fields, because they have gone beyond exploration stage. Farmers from Kyela were impressed with the dissemination methods used here in Morogoro apart from farmer to farmer Primary school and the Church are used effectively. They appreciated that these social institutions are very important in information/technology dissemination.

Later farmers exchange gifts and have a meal together bid fare well to each other
The closing note emphasized on the extending the information /technology to other people in the village and outside the village. In addition the ties between Kyela farmers and Morogoro farmer was highly commended and called upon farmers to maintain and strengthen it beyond the scope of the project.

General Observation

- Farmers showed a good level of understanding on what they are doing in their plots, they were able to express themselves, and answer well all questions.

- The size of their experimental plots was small probably because some farmers are participating for the first time and or being in exploratory stage of the application of the technology.

- Most of the plots are within their main fields showing a good level of acceptance of the technology

- Having informative poster in their plots as done by one farmer in Kibangile will assist dissemination of information/technology to other people in the village especially for plots which are adjacent to the roads or foot paths.

- The involvement of other social institution in the village like schools and churches is of vital importance in dissemination of information or technology as observed in Kibangile and Kiswira village.

- Using other means of reaching people in the village like the drama prepared by Kiswira village is a good machinery in driving the message to target population

- Most of the plots were planted on the same date showing that the group organisation is strong and productive.

- Most of the farmers planted TMV 1 maize variety showing an opportunity of introducing the use of improved maize seed in the project

From these observations It was learnt that
- The linkage between Research Extension and farmer is enhanced
- Farmers appreciated the use of the technology in improving agriculture production
- Records are very important tool in evaluation of the progress
- It is important to use various means in extending the information because no single method is efficient
- Research Institutions are very important in enhancing agricultural development

Appendix

1. The hisory of Tuwalole Farmer Research Group (Kiswira village)

The group started in 2002 with 20 members 8 women and 12 men. November 2002 group members were distributed with *Crotolaria* and pigeon pea (0068) seeds by Dr Mbwaga. The main objective was to plant these seeds to improve soil fertility and to control *Striga*.

On 30th January 2003 the group attended a workshop which enable the members to
a. To understand the research activity, opportunities, potentials and threats in agriculture production
b. To enable the group to have a common goal and set a common strategy in implementing and developing *Striga* control measure
c. To gather baseline data that are useful in evaluation of the project

February 2003 the group started to conduct a *Striga* control trial whereby *Crotolaria*, pigeon pea and maize were planted in plots of 5x10m2. The research team visited all plots for evaluation. On May 21,2003 the five group representatives joined representative from Kibangile to visit Kyela District to share experience with Kyela farmers who were in the project for 4 years. They saw how *Crotolaria* and pigeon pea cut the costs of using industrial fertilizers. After the tour, the group disseminated the technology to other farmers in the village.

Other group activities

The group has a registered credit society.

The group is disseminating *Striga* control technology/information in association with Catholic missionary institution in the village.

2. List of Participants

1. Dr A. Mbwaga	ARI – Ilonga
2. C. Massawe	ARI – Ilonga
3. E. Masangya	Agric Office Morogoro
4. J. Kayeke	ARI – Uyole
5. J. D. Mika	ZILO Office – Central zone Dodoma
6. Grace Thomas	Ward excutive Officer Matombo Morogoro
7. H. Kisamo	Ward Extension Officer
8. M Mwampaja	Agric Office Kyela
9. H. Mwangosi	Agric Office Kyela
10Asegelisye Mwaseba	Chairman FRG Kilasilo Kyela
11. Oscar Mbonge	Government leader, FRG Kilasilo Kyela
12. Agrrey Aliko	Vice chairman FGR Kilasilo Kyela
13. Nancy Mugogo	FRG Kilasilo Kyela
14. Erasto Mwaipopo	FGR Kilasilo Kyela
15. Tusajigwe Isumo	FGR Kilasilo Kyela
16. Samson Mwakanyamale	Chairman FRG Itope Kyela
17. Tide Kamwela	FGR Itope Kyela
18. Edward Mwang'onda	FGR Itope Kyela
19. Rehema Mwalaba	FGR Itope Kyela
20. Matilda Said	FRG Kibangile Kibangile Morogoro
21. Pili Mohamed	FRG Kibangile Kibangile Morogoro
22. Stephania John	FRG Kibangile Kibangile Morogoro
23. Ahmad Dulege	FRG Kibangile Kibangile Morogoro
24. Alli Shomari	FRG Kibangile Kibangile Morogoro
25. Abdu Rajabu	FRG Kibangile Kibangile Morogoro
26. Filbert Roman	Chairman FRG Kibangile Morogoro
27. Joseph Amos	FRG Kibangile Morogoro
28. Abdu Alli	FRG Kibangile Morogoro
29. Salum Ahmad	FRG Kibangile Morogoro
30. Kwayu Daulela	FRG Kibangile Morogoro
31. Hadija Salum	FRG Kibangile Morogoro
32. Abel Ngunda	FRG Kibangile Morogoro
33. Saleh Ahmad	FRG Kibangile Morogoro
34. Anjela Aloys	FRG Kibangile Morogoro

35. Halima Ramadhani	FRG Kibangile Morogoro
36. George Mkami	Chairman FRG Kiswira Morogoro
37. Edward Mawango	FRG Kiswira Morogoro
38. Albertina Thomas	FRG Kiswira Morogoro
39. Magdalena John	FRG Kiswira Morogoro
40. Otto Mzeru	FRG Kiswira Morogoro
41. Siril Henry	FRG Kiswira Morogoro
42. Isdori Malini	FRG Kiswira Morogoro
43. Vicent Midongo	FRG Kiswira Morogoro
44. Paol Matei	FRG Kiswira Morogoro
45. Germana Peter	FRG Kiswira Morogoro
46. Daudi Mdachi	FRG Kiswira Morogoro
47. Michael Roman Mloka	FRG Kiswira Morogoro
48. Antonia Antony	FRG Kiswira Morogoro
49.Veronica Dominic	FRG Kiswira Morogoro
50. Emma Mwenda	FRG Kiswira Morogoro
51. Christa Revenus	FRG Kiswira Morogoro
52. Anamaria Paul	FRG Kiswira Morogoro
53. Phillipina Yakobo	FRG Kiswira Morogoro

3.KILASILO RESEARCH GROUP REPORT (KYELA FARMERS VISIT MATOMBO MOROGORO RURAL)

1. Introduction:

The tour started from 26th May 2004 up to 29th May 2004. It included six farmers from Kilasilo, four farmers from Itope and two Extension officers from District Agricultural Office. The names of the participants are shown on the list of participants

2.Objective:

The main objective of the tour was to visit Marajea fertility improvement trials that are conducted by Matombo farmers. This was done to exchange ideas and experiences on *Striga* control trials that are conducted by both villages.

3. Activities:

a. A visit to Farmer Research group in Kiswira village

On 27th May 2004 ten research plots were visited in Kiswira village, the plots belong to the following farmers

Konstantin Antony Lukoba
Albertina Thomas
Otto Mzellu
George Shomari Mkami – Chairman
Jeremana Petter

Ldyia John
Siril Henry
Antonia Antony
Paulo Mateo Shomvi
Daudi Mdachi

We saw nice plots of Marejea, pegeon pea and maize which were in a good stage of growth. We advised them to

- Increase the size of their plots
- Plant early on the on-set of the rain season
- Use Marejea to improve soil fertility, control *Striga* and reduce weed infestation
- Use contours to control soil erosion on steep slopes

What was learnt from Kiswira village:

- The way of dissemination of the Marejea technology by using the Church in the village.
- Their plots are close to the main paths and one of the plot is close to the church so that many people can see it
- They prepared a drama which convey a message on the use of Marejea technology to improve production instead of false beliefs
- The history of Kiswira group

b. A visit to Farmer Research group in Kibangile village

On 28th May 2004 we visited Kibangile farmers research group. The visited plots are of

Philbert Roman Balala- Chairman
Anjelika Aloys- Vice chairman
Josephina Amos- Secretary
Abdu Ally
Halima Ramadhani
Hadija Salum
Kibangile Primary School

.
Their plots were of Marejea, pigeon pea and rice. The plots were good but small we gave them the same advice as that we gave Kiswira farmers.

What was learnt from Kibangile village:

- Dissemination of marejea technology by using primary school pupils who are the future farmers.
- In each plot in the trial managed by the Chairman there was a poster showing the date of planting, weeding and the size of the plot.
- Short history of the group

Acknowledgement:
We would like to thank all who participated to facilitate the tour, these include
The leaders Dr A. Mbwaga and his colleagues

District Agricultural Office (Morogoro) Mrs E. Masangya
Ward Executive officer (Matombo- Morogoro) Grace Timoth Sholle, and Mr H A Kisumo (Extension officer Kisemu Division)

Kiswira village
Mr Patric Franasis-Village chairman
Leaders of the Catholic Church in the village
All farmer research group members

Kibangile village
Village chairman
Village executive officer
The headteacher
All teachers
All farmer research group members

On 29th May 2004 we started off to Kyela

Asegelisye Mwaseba
Group Chairman, Kilasilo

4. ITOPE RESEARCH GROUP REPORT
(KYELA FARMERS VISIT MATOMBO MOROGORO RURAL)

Introduction:
On 26th May 2004 we arrived at Morogoro where we met Dr Mbwaga. The next day we payed a courtesy call at Agricultural District office than we left to Matombo.

Activities:
We visited Kiswira village accompanied by District Agricultural officer, Ward Executive officer and ward extension officer. We visited nine plots that had Marejea, rice and pigeon pea. The crop stand in the field was good.

On 28th May 2004 We visited plots of six farmers in Kibangile village one of the plots belong to Kibangile primary school. The plot had marejea, pigeon pea and maize.The crops in the field were good.

What was learnt:
- They cooperate and coordinate filed operations like planting.
- Their plots are well attended
- They cooperate with extension officers, teachers and pupils
- The climate is warm like that of Kyela

Edward Mwang'onda
Group Chairman, Itope

5. DISTRICT AGRICULTURE OFFICE REPORT
(KYELA FARMERS VISIT MATOMBO MOROGORO RURAL)

1. Introduction:
The tour included six farmers from Kilasilo village and four farmers from Itope village, accompanied by extension officers M. Mwampaja and H. Mwangosi. The main purpose of the trip was to go and see efforts of Matombo farmers to control *Striga* in their maize and rice fields, previous season Motombo farmers visited Kilasilo and Itope village in Kyela District for the same purpose.

2. Leaving for Matombo via Morogoro
The journey started on 25th May 2004, we arrived at Morogoro on the same day. We met Dr Mbwaga and Mr. Massawe (ARI Ilonga) whom the next day together with Mr J Kayeke (ARI-Uyole) and Mrs Masangya (District Agricultural Office-Morogoro) accompanied us to Matombo.

We arrived at Mtamba the headquarters of Matombo ward around 11:00. There we met our hosts who had made all the necessary arrangement for out stay there. We started-off to our fist destination accompanied by Ward Executive officer Grace Timith and the extension officer H. Kissumo.

3. At Kiswira village
We were welcomed by the village government chairman, after introduction we went to the field. We started with the plot of Constantine A. Luka , but due to a shortage of time we visited only ten trials. The total number of participating farmers is 20 where eight are women.

3.1 What we saw in the field
- In Matombo there are two species of *Striga* (locally known as Sani) *Striga asiatica* and *Striga forbesii* while in Kilasilo and Itope there is only *S. asiatica*.
- The main crop in Kiswira is maize while in Kilasilo and Itope is rice.
- Apart from Marejea and Pegeon pea being used to fertilize the soil there is another cover crop called Clark (*Pueraria spp*). This was found in chairman's plot
- The rains for the season of 2003/04 were not good for the crop
- Mwangulu rice from Kyela is performing well in Kiswira, it was planted in Lydia's plot on behalf of the group. In addition she had maize and pigeon pea like other farmers
- Intercropping of maize and pigeon pea as a personal initiative of Mr Mdachi
- Improved varieties of maize Staha, TMV1 and pigeon pea Mali are used in the trials
- The plots size in the trial range from 5x10m^2 to 25x25m^2
- The date of planting was observed by all participating farmers as directed by the extension officer

- This was the second season for the trial but there is a number of farmers who showed interest and join the research group

3.2 Advice given
- Otto Mzellu was advised to make furrows across the slope because of the steep slope of his plot
- Participating farmers were advised to use the technology in large plots instead of the small ones which they have now

3.3 Wrap up session
A wrap up session was held before leaving for Mtamba. During the session
- The History of the research group was given. The group has a savings account in the bank. The group use the church for dissemination of the information about *Striga* control using Marejea and pigeon pea
- The group showed a drama which call upon farmers to fertilize their field by Marejea and pigeon pea to improve productivity instead of embracing false beliefs
- There was an exchange of gifts between newcomers and host farmers' groups also there was meal and drinks for the newcomer
- The Ward Executive officer appreciated the technology and pointed out that all the 33 village in her Ward are infested with *Striga*
- Mr Kayeke appreciated the effort of farmer who inter-crop maize and pigeon pea, and emphasized on the use of improved varieties
- Dr. Mbwaga emphasized on the improvement on the size of the plots leaving the small plots which are used by participating farmers. He congratulated them for forming a credit society (SACCOS)

Other congratulations and encouragement were from Mr Mwampaja, A. Mwaseba and T. Kamwela. The session was closed and we left for Mtamba

4. At Kibangile village
The next morning we visited Kibangile where we met participating farmers, their leaders including a village government chairman (Yahya Selemani). There we introduced each other before a trip to the field. Due to shortage of time, we visited plots of six farmers and that of the primary school.

4.1 What we saw in the field
- The problem of *Striga* is of the same magnitude as that of Kiswira
- Their fields are infested with two species of *Striga* like Kiswira
- The knowledge to combat *Striga* is given in different ways by the primary school like a demonstration plot, choir and poems
- Crops which are used in their plots are maize and rice
- The average size of the plots is 15x15m^2
- The variety of pigeon pea planted is mali
- Group members are increasing after appreciating activities of the group

4.2 Advice given
They were advised to increase the size of their plots in the following season

4.3 Wrap up session

At the meeting, Kibangile primary school pupils conveyed a message of *Striga* control by choir and poems. During the session

- The short history of the group was given by the vice chairman of the group
- On behalf of the visiting farmers, Mr Oscar Mbonge and Erasto Mwaipopo congratulated the group for the development reached and called upon them to continue with the same spirit. In addition Mr Mwangosi praised the effort of the school to convey the message of *Striga* control, while Mrs Masangya requested all participants to put into practice what they have learn from the tour.

Then newcomers were saved with lunch before leaving for Morogoro

5.0 Conclusion

Farmer exchange visits are very important and give a challenge to participating parties. Apart from meeting others, there are chances of exchanging ideas, experiences and encouraging each other in their efforts to control *Striga*. Therefore, the efforts of Project coordinator Dr Mbwaga, Tanzania government and the donors are highly acknowledged for facilitating this exchange visit.

Prepared by M. Mwampaja
District Crop Officer

Incorporation of Awareness and Control of Striga in the school curriculum

Project No. R8194 (ZA0511)
Project Working paper No. 5

A. M. Mbwaga

December 2003

Project Implementation Team Members:

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8. District Education officers (Kyela and Morogoro Rural districts)
9. DALDOs (Kyela and Matombo-Morogoro Rural districts)
10. Agricultural Extension Officers at respective trial sites both in Kyela and Matombo-Morogoro Rural districts.

Teacher and Extension officers during Workshop group discussion, Kyela July 2003;

Preface

Striga species, the so-called witchweed, are widespread on the fields of small holder farmers in semi-arid areas of Eastern and Southern Africa. These noxious parasitic weeds principally attack and reduce the yield of finger millet, maize, sorghum and upland rice in these regions. In many areas it is the crops of resource-poor households that are affected by these weeds. In Tanzania upland rice is attacked by *S. asiatica* in a number of areas. Since 1996 staff from Ilonga Agricultural Research Institute and Sokoine University in Tanzania, and Natural Resources Institute in UK have been collaborating with district agricultural extension in studies aimed at developing integrated *Striga* management practices for the rice crop. Studies have been undertaken with two groups of rice farmers in Kyela District located in the Southern Highlands agricultural zone. Through on-farm trials the farmers came to appreciate that *Striga* infestation and poor rice production are associated with and indicators of low soil fertility. This in turn is a consequence of continuous rice cultivation in the absence of using any fertilizer or manure. While the trials demonstrated that up to a 60% reduction in *Striga* numbers and a 40% increase in rice yield could be achieved by using urea fertilizer farmers decided they did not wish to invest scarce cash in fertilizer. Instead they became interested in the opportunity, also observed from trials, to improve rice productivity on infested soils by introducing the green manure crop *Crotalaria*.

The current project "On-farm verification and promotion of green manure for enhancing upland rice productivity on *Striga* infested fields in Tanzania", operating from October 2002 to March 2005, aims to scale up the demonstration of using the green manure in rotation with rice in both Kyela (Mbeya Region) and Matambo (Morogoro Region).

The purpose of this report is to present the findings from the teacher's workshops conducted in Matombo-Morogoro rural and Kyela districts. These are two workshops, where the first inception workshop was conducted at both locations in November 2002 and the follow up workshop was in July 2003. The aim of the workshops was to explore the possibility of using agricultural primary school teachers to incorporate the knowledge of Striga in teaching curriculum for primary school pupils. The results are presented in the following pages.

Further information on the project or further copies of this report are obtainable from:
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Cover Page:
1. Teachers from Primary schools of Kyela district who attended Workshop in Kyela
2. Rice crop infested with *Striga asiatica*

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Table of Content

Executive Summary:

Workshops were held in November 2002 and July 2003 to enable participating teaching professionals in Kyela and Matombo-Morogoro rural districts to compare experiences of incorporating information on the improvement of soil fertility and hence control Striga by rice/maize rotation with green manure-Crotalaria into their teaching curriculum. The workshops were attended by the research and extension staff involved in the project "On-farm verification and promotion of green manure for enhancing upland rice productivity on Striga infested fields in Tanzania" (R8194).

All teachers gave a highly positive account of their experiences of incorporating awareness on the use of green manure to increase soil fertility and control Striga. Different teaching methods were described including lecturing, use of real objects in classroom situation, drama, songs, poems and field demonstration plots. In terms of resources theory was rated as the least expensive activity to undertake whereas undertaking demonstration/experimental plots for Kyela and for Matombo teachers cultural entertainment was considered the most demanding of the methods in relation to inputs including time and resources.

It was agreed that processes and methodologies adopted by the teachers were appropriate. Keys activities during the coming academic year and within the life of the project will be to demonstrate the use of Crotalaria for improvement of soil fertility and control of Striga, disseminate this information to other schools and farmers around their schools by using available forums.

The present challenge is to develop these firmly founded local platforms into a communication channel that extends to a wide-ranging audience. The school sector is clearly an important link in this pathway. A set of follow up activities to further establish this pathway was agreed.

I. Inception Workshop November 2002:

1.0. Introduction

Inception Workshop was held on 6th November 2002 at Matombo Morogoro rural and on 12th Kyela districts to enable participating teaching professionals to compare experiences of incorporating information on improvement of soil fertility and management of Striga in rice into school teaching curriculum.

I.1: Kyela District

1.1.1 Introduction:

Resource people and organizers of the workshop consisted of Researchers Teachers and Extension officers as follows;
Dr G. Ley (ARI- Mlingano), Mr. J Kayeke (Student Sokoine University of Agriculture) Dr. A.M. Mbwaga (ARI – Ilonga), Dr. C. Riches (NRI UK), Mr. R. Lamboll (NRI UK) Mr. P. Lameck (INADES- Dodoma), Mr. A Mwambungu (DALDO- Kyela), Mrs. J. Mwakapalala (**D**istrict **E**ducation **O**fficer's office Kyela). The workshop was conducted on 12-13 November 2002.

Researchers, participants and District leaders (DALDO and DEO) were requested by chairperson to introduce themselves.

The workshop was opened by DEO (District Education Officer), who called upon all participants to utilize the opportunity of attending this workshop to gain knowledge, which is important for their respective schools and district as a whole.

1.1 Objectives of the workshop

1.2 General objective: To incorporate awareness and management of *Striga* in the school teaching program.

1.2.1 Specific objectives:

1. To obtain participants' experience on how they obtain/ disseminate information to the society
2. To let participants understand the biology and effect of *Striga* on cereal crops
3. To set strategies for implementation of workshop declarations

1.3 Teachers' experience in obtaining and dissemination of information

In order to gather teachers' experience in obtaining and dissemination of information, two working groups were formed. Each group was given questions to answer so as to provide the required information to be presented during plenary session.

Group I: Information sources

- How is information obtained?
- What are the problems in obtaining information?
- How are the problems related to obtaining information solved?

Group II: Information dissemination
▫ What means are used to disseminate or teach new information?
▫What problems are encountered in dissemination or teaching of new information?
▫How are the problems related to dissemination or teaching of new information is solved?

1.3.1 Results from the group work:

Group I Information sources
Information is obtained through mass media (Radio, Television, and newspapers), posters, letters, telephone calls and visits.

Problems related to obtaining of information include, messages can be transformed, it takes longer to reach the target group, lack of experts (in specific field of study), poor communication, lack of education and health.

These problems are solved through:

Scrutinizing obtained information before dissemination

To make sure the information reaches the target group as early as possible e.g. for the parents it is sent through school children.

Teaching pupils for issues which are within the professional of teachers in schools

Discussion:
Q: Give example of information transferred through teachers
A: Health such as HIV/AID campaign and environmental conservation issues

Q: How do you go about when there is no expert of a certain teaching/information
A: Experts from other institutions are invited, sometimes village government leaders are used

Q: What is the response of farmers when they get information from teachers
A: The response is good depending on the target and follow up is important to create confidence

Q: Where are the letters and telephones calls you receive mainly come from?
A: Calls and letters we get mostly come from District authorities. The information passed to teachers' is normally channeled through District Education office.

Q: Give an example of an area where there is lack of professionals
A: Agricultural Extension officers are few; to cater for all villages and schools.
Q: Are those teachers teaching agricultural skills have attended a special course
A: No, the program has started for those who are presently in Teachers Training Institutes

Group II: Information dissemination:
Information is disseminated to the society by using posters, brochures and meetings.
Other means of dissemination are teaching in classes and through groups by local dances, poems, songs and acting

Problems related to dissemination of information are

- Lack of teaching aids like video, news letter, manuals etc.
- Lack of funds for seminars
- Poor means of transportation
- Negative attitude of the society
- Norms and culture which are against development
- Poor school attendance

These problems are **solved** by

- ♦ Looking for assistance from other sources
- ♦ Teaching the society the importance of news from radio, TV, news papers
- ♦ Teaching the society about better health, better agriculture practices
- ♦ Teaching about norms and culture so as to change attitude of mind about development

Discussion:

Q: How do you convey agricultural related information?
A: Demonstration plots are used without the assistance of Extension officers

Q: Are there parents' days in your schools?
A: There are no parents' days in schools

Q: Is it easy to get information from extension officers?
A: Not easy at all because their schedule of work is not known, in some villages they are seen working but in others they are not seen.

Q: Have you received any newsletter?
A: not at all

1.4.Biology of *Striga* and Integrated Control Measures

The presentation covered the following topics; types of Striga found in Tanzania, their economic importance, their distribution, *Striga* biology and possible integrated control options.

1.5 Key issues identified from group work and presentations:

1. The society was not aware of the effect of *Striga* on crop yield and the control measures
2. The knowledge of *Striga* is available at the District level but not to the target population i.e. farmers.
3. The society is dependent on obtaining and disseminating of information
4. The society doesn't look for or disseminate information related to development
5. There is poor interaction between professionals, leaders and other members in the society.

1.6 Strategies to address identified key issues

What to be done	What methodology	How should it work	By whom	When
1.	Educating the society	By incorporating the knowledge in skill studies, meetings, seminars and visits	Workshop participants	From 7th Nov 2002
2.	Advertising ourselves to the society	Posters, showing that the knowledge is available at schools. Disseminate information at meetings and other gatherings	Workshop participants	From 7th Nov 2002
3 and 4	Look for information ourselves	District offices, other professional, news letters, radio and Television	Workshop participants	From 7th Nov 2002
5	Recognize and respect each other	Ward /Village Development Councils, workshops and other gatherings	Workshop participants	From 7th Nov 2002

The workshop participants from Kyela were provided with *Crotalaria* and pigeon pea seed to be planted in their demonstration plots. It was agreed on the layout of the plots as shown below, so that next season all plots will be planted with rice. From the plots the participants had to assess Striga population and change in soil fertility through crop grain yield. The size of the plots were agreed to be 5m x 20m. and the lay out is as demonstrated below.

Crotalaria	Rice or maize	Pigeonpea 00040

Closing: The seminar was closed by DALDO – Kyela Mr. Mwambungu at 16hrs.on 13th 2002

1.7 Partcipants list:

1. Mr A Mwambungu DALDO Kyela District
2. Mrs J Mwakapalala DEO representative
3. Manjonjo Hussein Ally
4. Asiatu Barua
5. CM Kimaro
6. G Mwakasekele
7. P Kweka
8. B Kapolesya
9. H Mwaikinda
10. L Mwakibinga
11. EN Hamisi
12. L Mwakabwale
13. F John
14. R Mwambembela
15. J Kamwela
16. M James
17. J Mpangala

1.2: Matombo – Morogoro rural district

1.2.1 Introduction:

A Research team consisted of the following

Dr G. Ley (ARI- Mlingano), Mr. J Kayeke (Student Sokoine University of Agriculture)Dr. A.M. Mbwaga (ARI – Ilonga), Dr. C. Riches (NRI), Mr. R. Lamboll (NRI) Mr P. Lameck (INADES- Dodoma) and from the Morogoro rural district were Imelda L. Ishuza (DALDO rep- Morogoro), Emiliana E. Kishindi (DEOs office Morogoro) Evelyne Masangya (SMS - Morogoro). This was conducted from 6-7 November 2002.

Researchers did self-introduction, participants and District leaders (DALDO and DEO) introduced themselves.

DALDO representative opened the seminar and she called upon all participants to honor the opportunity of attending the seminar. She wanted them to use the gained knowledge to improve Agriculture production at their schools and to disseminate the knowledge to others who didn't get this opportunity to attend this seminar.

1.2.2 Objectives of the workshop

1.2.2.1 General objective: To incorporate awareness and control of *Striga* in the school teaching program.

1.2.2.2 Specific objectives:

1.To obtain participants' experience on how they obtain and disseminate information to the society

2. To let participants understand the biology and effect of *Striga* on cereal crops

3.To set strategies for implementation of workshop declarations

1.2.3 Teachers experience on obtaining and dissemination of information

In order to gather teachers' experience in obtaining and dissemination of information two groups were formed. Each group was given questions to answer so as to provide the required information

Group I: Information sources

▫ How is information obtained?
▫What are the problems in obtaining information?
▫How are the problems related to obtaining information solved?

Group II: Information dissemination

▫ What means are used to disseminate or teach new information?
▫What problems are encountered in dissemination or teaching new information?
▫How are the problems related to dissemination or teaching of new information solved

Results from the group work:

Group I: Information sources

Information is obtained through mass media (Radio, Television, Newspapers, brochure meeting, and seminars like this one and workshops.

Problems related to obtaining of information are poor communication, lack of radio and newspaper, poor education

The above mentioned problems are **solved** through leaders' meetings

Discussion

Q: How is information obtained from District authorities?
A: Through written letters

Q: What is the main source of letters received from district authorities?
A: The District Education office

Q: Are the information obtained comes on time and complete?
A: Sometimes information is delayed or information obtained is not complete or is lost on the way.

Q: How is information conveyed to the parents in a village?
A: Through school children.

Q: What should be done to improve information transfer from District level to villages?
A: Teachers need to be close to the District authorities

Group II: Information dissemination

Information is disseminated to the society by using posters, brochures, meetings, seminars and workshops.

Other means of information dissemination include teaching in classes, through available groups, local dances, poems, and songs.

Problems related to dissemination of information are

- Delay of information to reach targets
- Target groups sometime pay no attention to the message conveyed by means of art
- Lack of facilities such as telephones
- Lack of education on certain subjects

These problems are **solved** by

- Sending information direct to the target group (avoid long chain)
- Collaborating with other departments at District level
- Making use of the available resources
- Asking for assistance from higher authorities in the District

Discussion:

Q: Does norms and culture have effect on dissemination of some information?
A: Yes, normally precautions are taken not to offend the society

1.2.4 Biology of *Striga*, its effect on the crop and Integrated Control Measures

The presentation covered the following topics; types of Striga found in Tanzania, their economic importance, their distribution, their biology and possible integrated control options.

1.2.5 Key issues identified from working groups and presentations:

1. The society was not aware of the effect of *Striga* on crop yield and control measures
2. The knowledge of *Striga* is available at the District level but the target population is not aware
3. The society is dependent on obtaining and disseminating information
4. The society doesn't look for or disseminate information related to development
5. There is poor interaction and collaboration between professionals, leaders and other members in the society

1.2.6 Strategies to address identified key issues

What to be done	What methodology	How should it work	By whom	When
1.	Educating the society	By incorporating the knowledge in skill studies, meetings, seminars and visits	Workshop participants	From 11th Nov 2002
2.4	Create a behavior of seeking information/sources of information	Looking for information ourselves	Workshop participants	From 11th Nov 2002
3	We have to be creative	Making use of the available resources	Workshop participants	From 11th Nov 2002
5	Recognize and respect each other	Ward /Village Development Councils, workshops and other gatherings	Ward Executive Officer	From 11th Nov 2002

The workshop participants were provided with *Crotalaria* and pigeon pea seed to be used in their demonstration plots. It was agreed on the layout of the plots as shown below. During the next season all plots will be planted with a cereal crop rice or maize and then will be assessed for the population of *Striga* and change in soil fertility through increase in crop yield. The plot size for each treatment was agreed to be 5m x 20m

Lay out of the plots

Crotalaria	Rice/maize	Pigeonpea 00040

Closing:
DALDO representative from Morogoro rural district Ms. I. Ishuza closed the seminar at 15hrs.

1.2.7 Participants list:

Imelda L Ishuza
Evelyne Masangya
Emiliana E Kishindi
Grace Timoth
Charles Msimbe
Peter Fransis
Gabriel N Mkumbo
Osward Leo
Longin Hassan
Shija Joseph
Amos Fabian
Herriel Amir

II.Follow up workshop July 2003

2.0: Kyela District (18-19th July 2003)

2.1 Introduction

Research team consisted of the following

Dr. George Ley (ARI-Mlingano), Mr. J. Kayeke (Student Sokoine University of Agriculture), Dr. A.M. Mbwaga (ARI-Ilonga), Mr. P. Lameck (INADES- Dodoma), Mr. Mwambola, L.J. (DALDO – Kyela), Valeriana E. Mbena (DEO- Kyela)

The representative of DALDO opened the workshop. He emphasized the integration of the teaching profession into agriculture activities. He called upon the participants to prepare pupils to become future modern farmers.

2.2 Objectives of the workshop

1. Follow up of the Seminar on the Incorporation of *Striga* knowledge in primary school curriculum done on November, 2002
2. Planning for the coming cropping season

2.3. Individual presentation from individual schools for the 2002/2003 achievements

2.3.1 Ngamanga primary school:
By Catherine M. Kimaro

Introduction

The first workshop on *Striga* was held on 7/11/2002. The workshop helped us to know S*trig*a, its effect on cereal crops and methods of its control. During the workshop we were given tasks to spread messages to the public to inform the people that we are experts on S*triga*, to look for information on S*triga* and to know each other. Therefore the present workshop aims us to present the activities done since the previous workshop. The presentation will follow what has been done, achievements, problem encountered during implementation of the activities and the way forward or suggestions.

What has been done

Training

I taught about *Striga* to my fellow teachers at my Ngamanga primary school that includes ward education officer as one of the participants. The lesson took three days from 8-12/6/2003, from 3 p.m. to 4.40 p.m. I encouraged pupils to send the message to their parents and inform them about knowledge on *Striga*. Many parents came to learn about *Striga* and its control.

The parents had a problem of S*triga* on their maize and rice farms. I taught them about the biology of *Striga* and the various methods of its control including weeding before flowering, use of *Crotalaria*, mixing of maize and cow pea, use of herbicides and industrial fertilizer.

I also visited some of the farms and gave additional advice. I was able to see *Striga* with pink flowers clustering around maize plants. This created problem in weeding using a hand hoe.

Demonstrations

Striga teaching was conducted for class V and VII followed by field activities. We chose a field heavily infested with *Striga*. We divided the field into two equal parts. The first part was planted maize with mixed with cow- peas while the second had only maize.

Results

Yields were higher where maize was mixed with cowpea than maize alone. This indicated that legume crops have nitrogen that increase soil fertility from the root nodules as is the case with C*rotalaria*. Farmers were able to note this difference and appreciate the benefit of mixing maize and cowpea, something that farmers were not used to. Usually they mix rice and maize.

The demo has also confirmed that Striga affects mainly cereals e.g. maize and rice.

Conclusion

The demo has shown that planting maize and cow-pea in the same plot gives higher yield than planting maize alone on *Striga* infested fields. The farmers are ready to try if they see practically what has been done.

Problems

I encountered many problems the major ones include
-Some elderly people believe that *Striga* is witchcraft that can not be eradicated

-*Striga* emerged very close to the maize making weeding by hand hoe or pulling very difficult. This shows we do not have poison to kill S*triga* but we have technologies that are not appropriate to small-scale farmers.

Future plans

To conduct another demo using cowpea, C*rotalaria* maize and rice. I will involve std VI and VII pupils in order to add to their knowledge on control of S*triga.*
I will prepare plots of the same size, use the same seed, planting will be done the same day for all plots. All plots will be weeded the same time and all plots will be harvested the same day and weighed. *Striga* infested plots will be used

Suggestions

I will invite farmers, teachers and village leaders to come and see the demos. I will also give a seminar on S*triga*. In order for the seminar to be successful I suggest some incentive to be available as some of the participants will travel long distances

Acknowledgement

I would like to extend my gratitude to the Researchers from Ilonga, who gave me the knowledge about S*trig*a, to teachers at Ngamanga primary school for their

support and to pupils at Ngamanga, Bujonde and Ikolo primary schools for being receptive and Ngamanga villagers for their support.

2.3.2 Nkuyu primary School :
By Blandina Kapolesya

What has been done:

Following the 7th November 2002 workshop on S*triga* , I taught different categories of people including pupils, teachers, villagers and my neighbors. In doing this I used different environments: schools, homes, and churches.

Achievements

Many people got to know about S*triga* and its effects on cereal crops. They are now aware of different methods to control S*triga*. Through my research I noted that many people have seen S*triga* but are not aware on its effects on crops. Many of them use S*triga* as medicine to treat stomach problems. One pupil from Tukuyu, Segera area informed me that they use Striga to decorate their houses. Areas where many people I have contacted have seen S*triga* include Tukuyu around Segera, Itope Kyela, and Kakanje around Kyela valley and in open areas used for grazing.

Problems

I received few problems than achievements. The problems were as follows

-Some of the people have never heard or seen Striga so it took me long time to explain about it. The Striga picture I received during the first workshop helped me to get the message across.

-Some of the people did not take me seriously at first until they heard about the effect of Striga on crops.

-Some people perceived the word “kyumika” as a heart problem and S*triga* weed is used to treat the problem.

Future plans and suggestions

My future outlook is that if Striga is not controlled effectively it will spread fast may be faster than AIDS and create hunger that will kill more people than AIDS.

I suggest that Agriculture experts be fore front in combating Striga infestation using seminars, workshops and other methods e.g. using information centers, news papers, posters, leaflets, television and radio. The Ministry of Agriculture and food security in collaboration with the Ministry of Education and culture to ensure the issue of Striga is included in academic curriculum of primary, secondary and colleges.

Finally I suggest the Ministry of Agriculture and food security to increase the number of Extension workers in rural areas who will spread the message on the control of S*triga* throughout the country

2.3.3 Kiwira Coal Mine Primary school:
By Phillipine Kweka

Introduction

The S*triga* workshop of 7/11/2002 informed us about S*trig*a and its control. After the workshop we were given the task to spread the technology/message to the general public

What has been done

I gave a seminar to my fellow teachers for two days. The message was well received and the teachers promised to help in carrying out the trial on the school farm so as to spread the message. I taught class V and VI pupils about S*trig*a. its biology and effects to the crops and some control measure that include use of Crotalaria, mix crops within the same field. I displayed the Striga poster on the notice board. I directed pupils to give the lesson to their parents and neighbors. Some people came to me for further information.

I also explain Striga knowledge during church gatherings and I encouraged them to see me for any clarification.

The demonstration

I have prepared a land for demonstration within the school premises. I will involve the pupils. Other teachers will be able to use the trial for their practical classes. The trial will be of a great benefit for the pupils, teachers and farmers around us.

Problems

I could not contact some of the workers of Kiwira Coal Mine because of time limitation.

Conclusion

Within this short period the results have been good because people have started combating S*triga* and increasing the fertility of their soils contrast to the earlier times.

Future plans

I plan to conduct a demo at the school farm during the coming season. I will involve teachers, pupils and farmers around Kiwira Coal Mine

Suggestions

We suggest to use real objects during the forth-coming seminar. Real objects will attract more people, especially if the demos are done in farmers fields

2.3.4 Mbogela Primary school:

By Frida John

What has been done

I gave a seminar to teachers, it was well received and the teachers promised to use the knowledge for their classes. Fortunately all the teachers knew the Striga weed.

I submitted seminar materials I received on 7/11/2002 to the head-teacher so that he can use them to teach other people outside the school.

I taught 41 std VII pupils about S*triga* during the agriculture and livestock classes. I planted a small plot of Crotalaria on the school farm where maize was not doing well.

Achievements

-Teachers and pupils promised to plant Crotalaria on their plots where crops are

not doing well
-Pupils wanted to know more about S*triga* and to see the real S*triga* plant
-Pupils and teachers understood the importance of C*rotalaria*

Problems

-Farmers had no time to attend my seminar; they were busy on their fields
-In my area there was no S*triga*, so pupils did not have the opportunity to see the real S*triga* plant
-There was no transport to take pupils to sites where there was S*triga*

Future plans and suggestion

-Use real St*riga* plant for teaching pupils
-Continue giving seminars to the pupils
-Continue giving seminars to the public
-Extension officers and village chairman to receive the seminar so that they can spread the message to many farmers faster
-*Striga* study to be included in the school curriculum.

2.3.5 Lugombo primary school:
By R. Mwambembela

What has been done

-Made the public able to recognize S*triga*
-Made the public aware of the bad effects of S*triga*
-Made the public aware of the methods to control S*triga*
-Held different meetings to discuss about S*triga*
-Visit *Striga* infested fields and led the way to combat S*triga*
-Put poster displays in churches and in pombe shops
-Visit schools and explains how to combat S*triga*
-Showed leaflets, posters, booklets on S*triga*
-Demonstrated how to increase soil fertility using C*rotalari*a and later plant maize

Achievements

-Many farmers have understood what S*triga* is and how to control it

Problems

-Many farmers wanted to plant C*rotalaria* but time was too short to prepare land, plant C*rotalaria*, incorporate C*rotalaria* then plant another crop

Request

-farmers have requested for research on “Ndalala / Sanu” (Rice yellow mottle virus –RYMV) which affects rice in their fields

Future plans

-After seeing the benefit of C*rotalaria* on increasing soil fertility, many farmers are willing to plant *Crotalaria* next season

2.3.6 Nduka primary school:
By J Kamwela

1. Following the first seminar conducted on November 2003, I managed to teach the public through skill study classes, and agriculture talks, village meetings, I also went to hold talks at Ilima primary school and churches.

2. The subject was well received because farmers knew S*triga* but did not know how to control it. They gave another name for Striga “Kalilo” (Kindali).

3. I was limited in my work with time, lack of some of the inputs such as Urea and herbicides 2, 4-D. these inputs are very expensive. Small-scale farmers can not afford to buy them. Use of farmyard manure in the dry year increases the incidence of termites.

4.I suggested that specific time should be allocated to teachers so that it should not interfere with school classes. I also suggest that farmers should be provided with improved seed and that inputs such as fertilizer and herbicide should be easily accessible to farmers.

2.3.7: Mbogela primary school:
By G. Mwakasekele

What has been done

-I gave seminars to different categories of people in
Schools: teachers and pupils of Lubago Primary school
- Individuals: Mzee Mwakatage (Busale)
Mzee Mwahasaha (Ipinda)
Mzee Andawile (Lusungo)
Mzee Mwansyemela (Talatala)
- Churches: Roman Catholic Kyela
Roman Catholic Kapamisya
Roman Catholic Isanja-Bujonde

Achievements

- Many of the individuals have started taking measures to control *Striga*
- Lubago Primary school has started to use farm yard manure to improve soil fertility. They obtained better yield this year than previous years.
- The positive response of most of the people I have contacted

Problems

-Some teachers demanded allowances to attend the seminars
-High demand for the leaflet and posters on S*triga*, people want to refer back to some study material after the seminar

Future plans

-District education office should provide more time for teachers to visit other schools to give seminars on S*triga*.

- Request for more leaflets, booklets, and posters on S*triga* to give to our seminar participants.

- Request for additional C*rotalaria* seed.

2.3.8 Lema Primary school:
By Mary James

What has been done

After the seminar on 7/11/2002 I went back to my school and requested the head-teacher to allow me to explain to teachers and pupils what I have learnt from the seminar. The head-teacher prepared the timetable for me after normal school classes. I started with teachers. I explained to them all what I have learned about S*triga* (biology, effect on crops, types, control measures) then we visited the school farm to inspect if there is S*triga*. We conducted a trial by planting *Crotalaria* and thereafter planted maize. Maize performed well.

I also taught standard VI and VII pupils during skill study, some of the teachers in the neighboring schools and villages during various gatherings i.e. meetings, celebrations. To a certain extent I succeeded because some of the people knew S*triga* but did not know how to control it.

Problems

-Some people did not want to listen believing that God has brought Striga and human beings can not eliminate it.

-In adequate study materials e.g. leaflets, posters and booklets

Future plans and suggestion

-Distribute many leaflets posters and booklets

2.3.9. Lukwego Primary school:
By Lutusyo P. Mwakabwale

What has been done

After the workshop of 7/11/2002 I did the following

i. I taught about the control of S*triga* to

-All teachers in Lusungo ward

-Standard III – VII pupils of schools belonging to Lusungo ward

-Some of the villagers in Lukwego village

ii. I distributed Crotalaria seed to Lukwego and Lukama primary schools in order for them to improve the fertility of their fields

Results

i. *Striga* does not exist in Lukwego ward

ii. Rice in this area is attacked by rice Yellow Mottle Virus which dries rice plants
iii. Fertilizers not required because the soils are very fertile. Fertilizer applications make the plants tall and hence susceptible to lodging and lower crop yields.

Request

Help farmers to tackle the problem of Rice Yellow Mottle Virus disease

2.3.10 Kisale primary school:
Lauden Mwakibinga

What has been done

I taught about Striga through groups, meetings and individuals.

<u>Groups</u>: Football clubs e.g. Umoja, Kanga and Mpanda soccer clubs
<u>Meetings</u>: Through the following churches P.H.C, Baptist Church SDA Church. In total reaching about 35 people
<u>Schools</u>: Kisale primary school (13 teachers and 310 standard V – VII pupils)
<u>Individuals</u>: House visits

Achievements

There was a good response from the people contacted. They believed that the use of C*rotalaria* and farmyard manure will control S*triga*. Some people borrowed my study material on S*triga*

Problems

-Some people were suspicious that the exercise was for the teachers to earn money. Where were they all these years?
-It is difficult to obtain Striga free seeds
-Farmers do not have extra land to plant other crops
-Industrial fertilizers are expensive

Future plans

Time is not enough to go through the whole ward it is better to get the permission from the District Education office rather than the Head-teacher.

Suggestion: Pupils should visit other schools to share experience

2.4.0 Group Discussion on Teaching Methods

Three groups were formed and given questions to discuss in the session

2.4.1 Group I: Which teaching methods are used to teach pupils?

1. Lutusyo Mwakabwale
2. Richard Mwambembela
3. Lauden Mwakibinga
4. Manjonjo Ally

2.4.2 Group II: Which teaching methods are used to teach farmers?

1. Blandina Kapolesya
2. Catherin Kimaro
3. Jacob Kamwela

2.4.3 Group III: Explain the relationship between farmers, pupils and others. What could be done to improve the relationship?

1. Phillipin Kweka
2. Mary James
3. Henry Mwangosi
4. L. Mwambola
5. Frida John

2.5.0 Group presentations

2.5.1 Group I: Methods used to teach pupils

Lectures

More pupils can be reached easily but after a short time pupils are likely to loose concentration if it is too long.

Cultural entertainment

It makes a subject memorable, it takes long time to prepare it also needss a number of materials.

Group discussion

It is highly participatory, but a vocal pupil can dominate the discussion

Visits
Practical
Exercises
Newsletters
Radio programmes
Actual materials
Theory

2.5.2 Group II: Methods used to teach farmers

1). Questions and answers
2.) Discussions
3.) Theoretical tours
4.) Newsletters
5.) Lectures
6.) Posters
7.) Cultural entertainment
8.) Actual materials

and the society can be reached by
-School committee
-Ward Development Councils
-Parents meetings

-Using churches and mosques by the permission of the respective leaders
-Using influential persons
-Informal gatherings

2.5.3. Group III: The relationishipbetween farmers, pupils and other stakeholders
Information can spread by
-Local leaders
-Formal and informal gatherings
-Announcements
-Meetings and committee (WDC, school committee)
-Brochures and leaflets, radio and television
-Agricultural shows

Relationship
-Participation in development activities, social activities
-Attending special events like freedom torch rally, government leaders visits

2.6.0 Group work on identification of teaching methods:
Identification of teaching methods, these are theory, cultural entertainment, actual materials and experiment plots. Describe each teaching method with reference to the age, gender and customs of the target population, also with reference to the effect of climate and the environment.

2.6.1 Group I: Theory
<u>Advantages</u>
-It is independent of the season
-Its preparation takes short time
-One topic is taught at a time
-Few materials are needed for its preparation
<u>Disadvantages</u>
-It is not suitable for a big group with older age or very young audience
-Attendance can be affected by customs
-Not easily understood and easy to forget
-It is independent of gender

2.6.2 Group II: Cultural entertainment
-It is suitable for all ages
-It cut across gender
-Not effected by the environment
-It attracts a big group of people
-It teaches by entertainment
-It is easily memorable
-It is independent of customs
-It is not affected by season
-It is suitable for all level of education

2.6.3 Group III: Actual materials

Advantages

-Suitable for any level of education
-Suitable for all ages and gender
-It is easy to remember
-It attracts and encourages learning

Disadvantages

-Sometimes actual materials are not easily available
-Preparation of the teaching materials takes time
-Sometimes it depends on the season
-Sometimes it is affected by the environment

2.6.4 Group IV: Demonstration plots

-It is suitable for the age of 9 years and above
-It is affected by seasons
-It is independent of gender
-It is independent of customs
-It is suitable for all levels of education

2.7.0 Working groups to explore further development and exploitation of resources and linkages

2.7.1 Group presentations

2.7.1.1 Selected teaching methods

1. The use of actual materials
2. Theory- books, pictures and notes
3. Demonstration/experiment plots
4. The use of cultural entertainment

2.7.1.2 What are the advantages and disadvantages of the mentioned teaching methods?

The use of actual materials:

-It is useful for age of 5 years and above
-It is suitable for all genders
-It is not affected by customs/culture
-It is useful for any level of education
-Is affected by environment and season

Theory:

-Not suitable for young children below 9 years
-It is suitable to all genders
-It is not affected by customs/culture
-It needs a class with high level of understanding
-Not affected by environment and season

Demonstration/experimental plots:
-Not suitable for young children
-Not affected by gender
-Suitable for low level of education
-Not affected by customs/culture
-Is affected by environment and season

The use of cultural entertainment
-Suitable for all ages, all genders and all levels of education
-Not affected by customs/culture
-It gives chances of using more teaching aids
-Not affected by environment and season
-Time must be considered and agreed

2.7.2 Ranking of teaching aids and the need of using teaching aids

	RANKING	
Teaching Methods	**Importance of the teaching method**	**Need of teaching aids**
Actual materials	1	3
Theory	4	1
Demonstration / exp. plots	2	4
Cultural entertainment	3	2

2.8 Setting strategies for extending the knowledge of *Crotalaria* in the control of Striga

2.8.1 Group I: Within school

How will *Striga* control knowledge being incorporated in skill study in your school and what resources are you going to use?

-Meet the head-teacher for the permission then I will start by conducting seminars with teachers.

-Teaching pupils in skill study classes

-Look for an infested area for field visits.

-Teach by cultural entertainment e.g. dance, songs, poems and drama

Resources to be used are leaflets and brochures, posters, newsletters, books, lecture notes

2.8.2 Group II: Inter-schools

How will *Striga* control knowledge be incorporated in skill study in your school and what resources are you going to use?

-Request to visit schools will be sent to the respective head-teachers. Teaching will start with the head-teacher, then teacher and later pupils and the school committee. The method of teaching will include theory, cultural entertainment and actual materials such as Striga plants.

-Resources needed are Posters, pictures and actual materials

2.8.3 Group IIIa: To improve relationship between school farmers and government leaders

What relationships are there between teachers and pupils, farmers, agricultural extension officers and village leaders in your respective villages?. Suggest a better way of improving the existing relationship.

-There is a good relationship since all parties are working together in various developmental activities like dissemination of technical information, Ward Development Council committees and other social activities.

-The situation can be improved by visits, demonstration during graduation or parent days, using scheduled meetings and by involving agriculture extension officers in school agricultural activities.

2.8.4 Group IIIb: To improve relationship between school farmers and government leaders (Agricultural Extension Officers)

What relationships are there between teachers and pupils, farmers, agricultural extension officers and village leaders in our respective village. Suggest a better way of improving the existing relationship?

-Agricultural extension officers participate in Ward Development Councils, village meetings, and school committees.

-In seminars, demonstration plots and social activities

The situation can be improved by

-Meetings which involve all technical staffs in wards

-Teachers and extension officers can work together in order to educate school and the society better agriculture practices

-Newsletter, leaflets and brochures must be available to the wards and schools

-To involve teachers in seminars and other agricultural activities

2.9.0 FUTURE PLANS

Activity	**Participant**
Experiment plots	All school except Ngamanga
Cultural entertainment -Poems -Drama -Dance -Choir	 Kisale, Lema, KCM, Nkuyu, Lukwego Nduka Kyela, Kandete, Lusungo Mbula Kasumulu, Mbogela
Preparation of leaflets	Kisale, Kandete, Kyela, Mbogela
Educate School-school The whole society	 Mbogela(1), Kisale(2), Lusungo (1) All participants
Reporting	All participants (By April 2004) to the DEOs office and DALDOs office

2.10. Closure:

The representative of the District Education Officer closed the workshop by calling upon all participants to put the knowledge gained into practice in order to improve agricultural production in S*triga* infested areas. She emphasized to all participants to play their respective roles effectively to make sure that every thing will go as scheduled. However she promised that her office would carry a close supervision in day to day activities of the project

2.11. List of participants

Name of participants	Institute	Address
1. Catherine M. Kimaro	Ngamanga Primary School	P.O.Box 119 Kyela
2. Jacob A. Kamwela	Nduka Primary School	P.O.Box 497 Kyela
3. Blandina Kapolesya	NKuyu Primary School	P.O.Box 152 Kyela
4. Frida M. John	Lema Primary School	P.O.Box 72 Kyela
5.Lauden Mwakibinga	Kisale Primary School	P.O.Box 448 Kyela
6.Gilbert Mwakasekele	Mbogela Primary School	P.O.Box 72 Kyela
7.Valeriana E. Mbenna	District Education Office	P.O.Box 72 Kyela
8.R. Mwambembela	Lugombo Primary School	P.O.Box 285 Kyela
9.Henry Mwangosi	District Agriculture Office	P.O.Box 188 Kyela
10.Lutusyo Mwakabwale	Lukwego Primary School	P.O.Box 95, Ipinda, Kyela
11. Manjonjo H. Ally	Kyela Primary School	P.O.Box 6 Kyela
12.L.J. Mwabola	District Agriculture Office	P.O.Box 188 Kyela
13.Mary James	Lema Primary School	P.O.Box 72 Kyela
14.Phillipine Kweka	KCM Primary School	P.O.Box 72 Kyela
15.Joseph Mpangala	Lusungo Primary School	P.O.Box 72 Kyela
16.Asiatu Barua	Kasumulu Primary School	P.O.Box 97 Kyela
17.Hezron Mwaikinda	Kandete Primary School	P.O.Box 278 Kyela
18.Ester N. Hamis	Mbula Primary School	P.O.Box 464 Kyela
19.Michael Mwampaja	District Agriculture Office	P.O. Box 188 Kyela
20.J.Kayeke	Sokoine University of Agric	Jkayeke@hotmail.com
21.Dr. A.M. Mbwaga	ARI-Ilonga	Ilonga@africaonline.co.tz
22. Dr.G.J. Ley	ARI-Mlingano	Mlingano@kaributanga.com

3.0:Matombo – Morogoro rural district:

3.1 Introduction

Research team consisted of the following

Dr. George Ley (ARI-Mlingano), Mr J. Kayeke (Student Sokoine University of Agriculture), Dr. A.M. Mbwaga (ARI-Ilonga), Mr. P. Lameck (INADES- Dodoma), Mr. C. Massawe (ARI-Ilonga), and from the district were Mrs. E. Masangya (DALDO – Morogoro), Mrs. R. Munisi (DEO- Morogoro)The District Subject Matter specialist Ms Masangya opened the follow up seminar by calling all participants to use effectively the opportunity of gaining knowledge and then put it in practice for the betterment of the district and the nation as a whole.

3.2 Objectives of the Workshop

1. Follow up on the incorporation of *Striga* knowledge in primary school curriculum from activities agreed in November 2002
2. Planning for the coming cropping season

3.3 Presentation from individual schools for 2002/2003 achievements;

3.3.1 Gozo Primary School:

By Gabriel Mkumbo

The demonstration plots were prepared in November 2002 and plot size for each treatment was 2 x 5m^2. Planted were rice and *Crotalaria*. Pigeon pea was not planted because seed was stolen.

Achievement

Some farmers are already asking for *Crotalaria* seed after seeing its performance on the school plots

14kg of *Crotalaria* seed have been harvested this season

Problems

-Pigeon pea seed was stolen when thieves broke into the school premises
-Rice was not harvested because of bad weather
-Majority of farmers are slow in accepting the technology

Discussion

Q: Did you plough under C*rotalaria* or not
A: *Crotalaria* was not ploughed under, because we wanted to harvest seed.

Q: What attracted farmers since it was the first season and no results were available to be observed?
A: They were attracted by *Crotalaria* stand in the field, hopping that later they would solve S*triga* problem after being told that *Crotalaria* controls *Striga*
Q: Was the training done formally or informally

A: There was no formal training. Pupils participated in the demo plot while farmers were contacted informally. Later after the growth of *Crotalaria* in the field some farmers asked questions related to the knowledge of C*rotalaria*.

Q: Can you quantify the contacted farmers and pupils?
A: About 50 pupils and 3 farmers were contacted

3.3.2 Kibangile Primary School:
By Amosi Fabian

The technology of using *Crotalaria* was taught in skill study classes
The demo plot was prepared in November 2002
Due to bad weather *Crotalaria* and rice died. Replanting was done 3 times but all were in vein. The last attempt was done in June 2003, where only *Crotalaria* was planted. Goats destroyed the plot of pigeon pea.

Achievement:
Some farmers are aware of what is going on in the project concerning *Crotalaria* and *Striga*. On the other hand about 70% of the pupils are also aware of the project and the purpose of growing *Crotalaria*

Problems
- -Stray goats around the school destroyed the crops
- -The demonstration plot was severely affected by draught.
- -Time was too short to educate many farmers

Suggestions
- -There must be competition among villages, schools and individual farmers
- -Seed storage techniques are required
- -Pupils must participate in workshops and study tours

Future plans
- -The school has made a commitment to participate fully in the project so that after 3 years about 75% of the farmers will be aware of the benefit of the *Crotalaria* in improving soil fertility and control of *Striga*.
- -The school will be ready to produce and distribute seed of Crotalaria to other farmers

Discussion
Q: Since stray goats are a problem then how will the school be ready to produce seed?
A: The head-teacher has taken some measures to arrest the situation

Q: The target set by the school seems to be very high to reach, are you sure of reaching your target?
A: I will try
Q: During school holidays the plots were left without management, what measures are in place to manage the plots during school holidays?

A: There is a special program already in place

Q: Why did you decide to plant *Crotalaria* in lines?
A: That was done to ensure the few available plants are maintained to produce enough seed

Q: Since the technology was taught in skill study classes why only 75% of the pupil participated?
A: Std I and II Classes were not included

Q: How was the information transferred to the target farmers?
A: By School committees, school meetings, and village government meetings, the information reached about 500 people

Q: Why the time was not enough?
A: The contact was done to those who attended in formal meetings

Q: How did farmers got attracted to the technology because the results were not yet to be observed?
A: They appreciated the performance of the *Crotalaria* in the field

3.3.4 Mlono Primary School:
By Joseph Shija

The demo. plots were planted with maize, *Crotalaria* and pigeon pea. The plots were of 5m x 10m. TMV-1 maize variety was planted at a spacing of 75 x 30cm whereas pigeon pea was 1.5x1.25m. Thinning was done in March to have 2 pigeon pea plants per hill.

Achievement.

-8kg of maize was harvested from the plot
-Pigeon pea is not yet to be harvested
-*Crotalaria* is still in the field
-Pupils participated in the fieldwork
-The school committee was taught about the *Crotalaria* technology

Problems

-Weather was not good this season
-Extending the technology is a problem to the society that has lost hope in the crop performance

Future plans

-All plots will be planted with maize during the next season
-Another demonstration plot will be prepared
-The school will produce *Crotalaria* seed

-The school will continue to educate farmers on advantages of using Crotalaria to increase soil fertility and hence to control Striga

Suggestions

-Researchers should visit farmers in order to encourage them to use Crotalaria for improvement of soil fertility.

Discussion

Q: Data is very important in quantifying results; have you any?
A: No

Q: Why some plants of pigeon pea dried up?
A: The variety provided is susceptible to fusarium wilt disease, next season resistant variety will be provided (this information was provided by researchers).
Q: What methodology was used for pupils and why did the farmers in your village not accept what you taught them?
A: Pupils were taught in skill study classes, others were taught during meetings. Villagers in my village are difficult to work with them because of poor accessibility of the village.

3.3.5 Konde Primary School:
By Longin M. Hassan

The technology of using *Crotalaria* and pigeon pea to improve soil fertility was taught in skill study classes. Standard V, VI and VII were involved in the demonstration plots.

The demonstration plot of 0.25 acres was planted with *Crotalaria* and pigeon pea. *Crotalaria* is still in the field but for unknown reasons pupils uprooted pigeon peas.

Some farmers showed interests on the technology.
It was learned that the school has not enough land therefore the Division Officer was requested to assist the teacher to look for another piece of land. At the same time the representative of the District Education Office promised to look into the matter at higher district authorities.

3.3.6 Mtamba Primary School:
By Peter Francis

The demonstration plot was planted twice without success due to draught. The last attempt was done in June 2003. The plants of Crotalaria are still in the field.

Farmers who happened to ask questions about the demonstration plots were taught the importance of *Crotalaria* and pigeon pea in the control of *Striga* and improve soil fertility.

Discussions

Q: Why maize and pigeon pea were planted earlier than *Crotalaria*?

A: The school land was already allocated to other crops. Next season every thing will be okay

Q: Why *Crotalaria* was planted late since it was the introduced technology?
A: Bad weather did not allow early planting of *Crotalaria*

3.3.7 Matombo Primary School:
By Osward Leo

The demonstration plots were planted in an area of 5x10m each. All crops died because of draught condition.
In the school the technology was incorporated in skill studies where 130 pupils of std V, VI and VII were reached.

There was no problem because farmers in Matombo village are already participating in this project.

Suggestion

Pupils should visit other schools to share experience

3.4 Group Discussion on Teaching Methods

Three groups were formed and given questions to discuss in the session

3.4.1 Group I: Which teaching methods are used to teach pupils?

1. Shija Joseph
2. Amos Fabian
3. Osward Leo

3.4.2 Group II: Which teaching methods are used to teach farmers?

1. Petter Fransis
2. Longin Hassan
3. Gabriel Mkumbo

3.4.3 Group III: Explain the relationship between farmers, pupils and others. What should be done to improve the relationship

1. Rose Munisi
2. Grace Timoth
3. E. Masangya
4. Amir Hariel

3.5 Group Result presentations

3.5.1. Group I Teaching methods for pupils:

1. Lectures
2. Group Discussions
3. Questions
4. Participatory learning

5. Practical
6. Evaluation of what has been taught
7. Suggestions

3.5.2 Group II: Teaching methods for farmers:

1. Formal meetings in villages, division and ward
2. Pass messages through religious gatherings for example in churches and mosques
3. Visiting farmers in their fields
4. Use pupils to spread the news to their parents / guardians / farmers
5. The use of cultural entertainment for example poems, drama, dance and choir
6. Practical using demonstration plots

3.5.3. Group III: Relationship between farmers, pupils and other stakeholders

1. Villagers / farmers are members of the school committee
2. Villagers / farmers are parents/guardians of pupils
3. Pupils link parents and teachers

3.5.4 How to improve the situation

1. Villagers / farmers should be educated and participate actively in school committee and other village meetings
2. Villagers / farmers should be educated that school is their property and that they are responsible to maintain it
3. Village leaders are members of school board/committee at the same time the head-teacher is a member of village government committee.

3.6. Group Discussion on best practices

For pupils, the best teaching methods are theory and practicals

-Theory should be taught in skill study classes
-It should start by teaching fellow teachers
-It should be taught in a participatory manner
-To ensure good understanding of the topic, practical should be done on demonstration plots

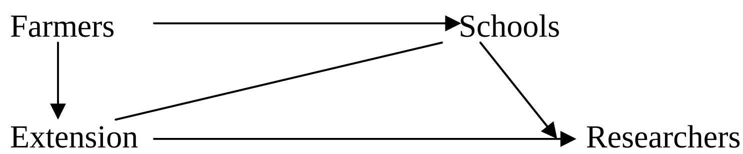
For farmers

-Theory should be taught with assistance from school committees and village government leaders
-Practical teaching by using experimental / demonstration plots
-By using cultural entertainment in gatherings

Relationship:

School committee consists of farmers, teachers and pupils
Village government consists of village leaders, teachers and technical staff

Figure showing relationships



-Teachers and agriculture extension personnel should know the responsibilities of each other so that they can work together in harmony.

-Research and teachers: There is a need for researchers and teachers to create a strong relationship

-Within school: There must be a strong relationship within school

-School to school: Relationship through Division Development Committees and Ward Development Council

3.7.0 Working groups to explore further development and exploitation of resources and linkages

3.7.1 Group presentations

3.7.1.1 Selected teaching methods

1. The use of actual materials
2. Theory- books, pictures and notes
3. Demonstration / experiment plots
4. The use of cultural entertainment

3.7.1.2 What are the advantages and disadvantages of the above mentioned teaching methods?

The use of actual materials:

-It is useful for the age of 5 years and above
-It is suitable for all genders
-It is not affected by customs/culture
-It is useful for any level of education
-Is affected by environment and climate

Theory:

-Not suitable for young children below level of standard V
-It is suitable to all genders
-It is not affected by customs / culture
-It needs a class with high level of understanding
-Not affected by environment and climate

Demonstration/experimental plots:

-Not suitable for young children
-Not affected by gender
-Not suitable for young children below level of standard V
-Not affected by customs / culture
-Is affected by environment and climate

The use of cultural entertainment
-Suitable for all ages, all genders and all levels of education
-Not affected by customs / culture
-It gives chances of using more teaching aids
-Not affected by environment and climate
-Time must be considered and agreed

3.7.2 Ranking of teaching aids and the need of using teaching aids

	RANKING	
Teaching Methods	**Importance of the teaching methods**	**Need of teaching aids**
Actual materials	2	2
Theory	4	1
Demonstrations / exp. plots	1	3
Cultural entertainment	3	4

3.8. Setting strategies for extending the knowledge of *Crotalaria* in the control of *Striga*

3.8.1 Group I: Within school

There are three groups: teachers, pupils (I – IV) and (V – VI)

Group	Teaching Method	Materials
Teachers	-Teachers meetings -Reporting after workshops	Posters, brochures, leaflets, books, pictures, actual materials like plants, seeds
Pupils (V – VII)	-Skill study classes -Self reliance activities -Graduation day -Parents day	Actual materials, pictures and posters, books, choirs
Pupils (I – IV)	-Skill study classes -Self reliance activities -Graduation day -Parents day	Actual materials, pictures and posters

3.8.2 Group II: Inter-schools

Teaching method	**Materials**
-School visits -Request for presentation in the division development committee and ward development councils -School to school invitations	-Cultural entertainment -Actual materials -Theory when there is gathering -Demonstration / experiment plots

3.8.3 Group III: To improve relationship between schools, farmers and government leaders

-Enables teachers to participate in village, division and ward meetings so that they can disseminate information / technology

-Invitation to parents in meetings and open/parents days so that they can visit the demonstration plots

-Farmers day and during special events say the visit of government leaders

Methods to be used:

-Cultural entertainment

-Demonstration/experimental plots

-Actual materials

-Posters, brochures and leaflets

3.9. SUMMARY

-Informal gatherings were not used at all
-Skill study classes were not utilized fully
-Fellow teachers in the same school were not given the knowledge of *Striga* and *Crotalaria*
-Experimental results are not yet confirmed
-Results in some of the reports are not quantified
-More efforts are required on the research plots

3.10. FUTURE PLANS

1. All participating schools will prepare demonstration/experimental plots.
2. All schools will prepare cultural entertainment like choirs, poems, drama and local dance.

Cultural entertainment	**Kibangile**	**Konde**	**Mlono**	**Matombo**	**Mtamba**	**Gozo**
Choir	+			+	+	
Poems	+	+		+	+	+
Drama	+	+				
Tradition dance	+		+			

3. All schools will participate in extending the knowledge to the society, school and all leaders

4. All activities done should be reported by March 2004

3 **11. List of participants**

Name of participants	Institute	Address
1. Gabriel Mkumbo	Gozo Primary school	P.O.Box 610 Morogoro
2. Longin M. Hassan	Konde Primary school	P.O.Box 610 Morogoro
3. Grace E. Timothy	Ward Executive officer	P.O. Box 681 Morogoro
4. Osward Leo	Matombo Primary school	P.O.Box 640 Morogoro
5. Herriel Amir	Division Extension Officer	P.O.Box 747 Morogoro
6. Rose Munisi	District Education office	P.O.Box 610 Morogoro
7. E. Masangya	District agriculture Office	P.O. Box 747 Morogoro
8. J.Kayeke	Sokoine University of Agric	Jkayeke@hotmail.com
9. Dr.G.J. Ley	ARI-Mlingano	Mlingano@kaributanga.com
10.Petter Fransis	Mtamba Primary school	P.O.Box 610 Morogoro
11.Amos L Fabian	Kibangile Primary school	P.O.Box 610 Morogoro
12.Shija Joseph	Mlono Primary school	P.O.Box 610 Morogoro
13. Cornel Massawe	ARI – Ilonga	Private Bag Ilonga Kilosa
14. Coster Roben	Ward Executive Officer	P.O. Box 1880 Morogoro
15. Dr. A.M. Mbwaga	ARI-Ilonga	Ilonga@africaonline.co.tz

Appendix 1: **Follow up workshop programme July 2003**

Programme activities:

Day one: Shaping and sharing of information

1.0 Welcome and Introduction	DALDO
2.0 Objectives of the Workshop	Mbwaga
3.0 Self Introduction	All
4.0 Individual presentations of the experiences of participating Teachers	Teachers
5.0 Coffee break	
6.0 Group Discussion on Teaching Methods	Teacher Groups
7.0 Presentation of Group Discussions on teaching methods	Group chairperson
8.0 Lunch	
9.0 Presentation of Group Discussion continue	
10. Questions and answers on Teaching Methodologies	All
11. Soft drink	
12. Group discussion on Best Practices (Consensus Session)	Facilitator

Day 2: Moving forward:

1.0 Working groups to explore the further development and exploitation of resources and linkages	Teacher Groups
2.0 Coffee	
3.0 Group Presentations	Chairpersons
4.0 Lunch	
5.0 Discussion on Presentations	Facilitator
6.0 Consensus Session (Moving forward)	
7.0 Closing Remark	DEO

Details of the Programme

Day 1: Shaping and sharing teacher's experiences:

1.0 Individual presentation of the experiences of participating teachers

2.0 Group discussions on teaching methodologies

- 2.1 Group 1- Our pupils
- 2.2 Group 2- Our farmers
- 2.3 Group 3- Linkages
- 2.4 Discussion on best practice-consensus session

Day 2: Moving forward:

3.0 Development and exploitation of resources and linkages

- 3.1 Group 1-1School to school linkages
- 3.2 Group 2- Transfer within school
- 3.3 Group3 Strengthening linkages – Researcher perspective
- 3.4 Group4-Strengthening linkages – teachers perspective
- 3.5 Group 5-Strengthening linkages – extension perspective
- 3.6 Moving forward – consensus session

Apendix 2: Questions to check understanding of the workshop

1.0 Je ulihudhuria semina iliyopita? - **ndiyo/hapana**

2.0 Je semina hii imekuongezea ujuzi wowote? – **Ndiyo/hapana**

3.0 Ujuzi ulioupata katika semina iliyopita, uliweza kuutumia katika kufundisha wanafunzi muhula huu/uliopita? – **Ndiyo/hapana**

4.0 Umetumia njia gani katika kufundisha wanafunzi/wakulima juu ya utaalamu huu?

1.
2
3
4
5
6
7

5.0 Kuna wanafunzi wangapi katika shule yako?, Taja shule na idadi ya wanafunzi kufuata madarasa

la 1…………………
2…………………
3…………………
4…………………
, 5…………………
6…………………
la 7…………………

6.0 Kueneza utaalamu:

6.1 Unadhani semina hii imekuongezea ujuzi wa kuweza kueneza utaalamu huu kwenye shule zingine? **Ndiyo/hapana**

6.2 Umeshaelewa aina ya zana utakazohitaji kueneza utaalamu huu? **Ndiyo/hapana**

6.3 Unafikiri semina hii imekuelimisha namna ya kujenga uhusiano kati ya Mabwana shamba/Watafiti na Waalimu (Shule/Msingi)? **Ndiyo/hapana**

Appendix 3: Answers from workshop questionnaires
(ii) Kyela District

At the end of the seminar the participants filled a questionnaire which acted as an evaluation of the workshop. The information captured is summarised below. Due to short of time this was not done in Matombo

1. Number of delegates who completed the questionnaire
-Teachers =16 (including District Education Officer)
-Extension Officers = 4

2. Response to various questions

Questions	**Number of response**	
	Yes	**No**
1. Did you attend the last seminar?	14	2
2. Has the seminar enhanced your knowledge?	16	0
3. Did you manage to use the knowledge from the previous seminar into the last or this academic year?	14	2
4. Do you think this seminar has enhanced your ability to extend the Striga knowledge to other schools?	15	0
5. Have you understand the tools required to extend the Striga knowledge	16	0
6. Do you think the seminar enabled you to create effective links between among extension workers/researchers and teachers (school)	16	0

3. Teaching methodology used

Methods used	**Number of teachers**
1.Read objects	7
2.Experimental plots	7
3.Discussions	3
4.General meetings	7
5.Questions and answers	2
6.Lectures	10
7.Posters/leaflets/booklets	4
8.Visit individual farms	6
9.Religious meetings	1
10.School staff meetings	1

4. Total number of pupils for 12 schools for each class (two schools did not provide the information). One school was presented by two teachers

Class	Number of pupils
1	1157
2	949
3	673
4	719
5	421
6	477
7	430

ENHANCING PRODUCTIVITY OF UPLAND RICE THROUGH ROTATION WITH GREEN MANURE ON *STRIGA* INFESTED SOILS IN KYELA AND MATOMBO :

SOME FINDINGS OF SOCIO-ECONOMIC BASELINE STUDY.

Project No R8194 (ZA0511)
Project Working Paper No. 6

J. Hella Sokoine-University of Agriculture
A. M. Mbwaga-ARI Ilonga

January 2004

ENHANCING PRODUCTIVITY OF UPLAND RICE THROUGH CROP ROTATION WITH GREEN MANURE (CROTALARIA) ON STRIGA INFESTED SOILS OF KYELA AND MATOMBO-MOROGORO RURAL DISTRICTS

SOME FINDINGS OF SOCIO-ECONOMIC BASELINE STUDY

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Mwambungu DALDO Kyela Kyela District

Mrs Masangya Subject Matter Specialist Morogoro Rural District
Extension officers in the respective villages

COVER PAGE:
Rice crop to the left and to the right Crotalaria, which will be followed by rice crop next season

Preface

Striga species, the parasitic witchweeds, are wide spread in small holder crops in semi-arid and sub-tropical regions of Eastern and Southern Africa. These weeds attack and reduce the yield of maize, sorghum, upland rice and finger millet in these regions. In many areas it is the crops of resource-poor households, which are particularly affected. They impose additional stress with which farmers, who have little resources for investments in crop production, have to cope in an environment characterized by marginal rainfall for cropping and declining soil fertility.

Since 1996 staff from the Department of Agricultural Research Development, Sokoine University of Agriculture and Extension in Tanzania and, Natural Resources Institute in UK have collaborated to develop integrated Striga management practices for rice crop. Studies have been undertaken with groups of rice farmers in Kyela district, in the Southern Highlands of Tanzania.

Through on-farm trials farmers came to appreciate that Striga infestation and poor rice production are associated with and indicators of low soil fertility. This in turn is a consequence of continuos rice cultivation in the absence of using any fertilizer or manure. While the field trials demonstrated that up to a 60% reduction in Striga numbers and a 40% increase in rice yield is achieved by using urea fertilizer, farmers decided they did not wish to invest scarce cash in fertilizer. Instead they became interested in the opportunity, also observed from the field trials, to improve rice productivity on Striga infested soils by introducing the green manure crop Crotalaria.

The current project is on "On-farm verification and promotion of green manure for enhancing upland rice productivity on Striga infested fields in Tanzania". It is operating from October 2002 to March 2005 with aims to scale up the demonstration of using the green manure in rotation with rice in both Kyela (Mbeya Region) and Matambo (Morogoro Region).

This report examines selected baseline socio-economic data in rice farming community in Kyela and Morogoro rural districts in Mbeya and Morogoro regions respectively.

Further information on the project or further copies of this report are obtainable from:

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Tanzania
Ilonga@africaonline.co.tz

Privious project reports

1. Mbwaga, A. M, Riches, C.R and Lamboll R.I. 2003: Enhancing productivity of upland rice on Striga infested soils: Village meetings to design the demos Programme Kyela-Matombo.

2. P. Lameck and A. Mbwaga: 2003. Enhancing productivity of upland rice on Striga infested soils: Context Analysis for four villages in Kyela and two villages in Matombo-Morogoro rural districts

3. A. Mbwaga, C. Riches 2003: Monitoring Demonstrations of soil fertility enhancing practices Kyela and Matombo-Morogoro rural districts

4. A. Mbwaga, C. Massawe, J. Kayeke 2003. Farmers Exchange Visits Report, Relevance and Lessons, Kyela district, Mbeya region

5. Mbwaga et al. 2003: Incorporation of Awareness and Control of Striga in the school curriculum

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Table of Contents

Executive Summary:

This report examines selected baseline socio-economic data in rice farming community in Kyela and Morogoro rural districts in Mbeya and Morogoro regions respectively. Purposefully and random sampling techniques were used to select a sample. Respondents currently participating in on-farm Crotalaria - pigeon pea/rice demo trials research were purposely selected and non-participating farmers were randomly selected. Questionnaire was used to collected information from 177 respondents from six villages where the project to “enhance productivity of upland rice on Striga infested soils” is being implemented. The results obtained revealed that there is greater diversity across households in terms of resource ownership, crops produced and the production methods, and perception about the nature and magnitude of the problem under investigation. Consequently approaches used to implement the project should have both technology and people centered outlook.

1.0 Introduction

Striga species, the parasitic witchweed, are wide spread in small-holder crops in semi-arid and topical regions of Eastern and Southern Africa (Dogget, 1980). These weeds attack and reduce the yield of maize, sorghum, upland rice and finger millets in these regions. In many areas it is the crops of resource poor households, which are particularly affected. They impose additional stress with which farmers, who have little resources for investments in crop production, have to cope with in an environment characterized by marginal and highly variable rainfall for cropping and declining soil fertility.

Since 1996 staff from the Directorate of Research and Development (DRD), Sokoine University of Agriculture and Extension in Tanzania and Natural Resource Institute in UK have collaborated to develop integrated Striga management practices for rice crop. Through on-farm trials studies implementing an integrated project to develop and/or introduce appropriate management options for Witchweed (*Striga spp*) infested upland rice based cropping systems in Kyela and Morogoro rural districts in Southern highlands and Eastern zone have, respectively, been carried out. Information collected through PRA in selected Striga infested villages in the zone and available literature (e.g. see Mloza-Banda, 1996; Ransom *et. al*., 1997; Sibuga *et. al.*, 2002) resulted into formulation of several possible options from, which possible treatments were introduced to farmers in four villages in Kyela and two villages in Morogoro district during the 2001 season. Green manure such as sunhemp (*Crotalaria spp*); trap crops such as cowpea (*Vigna unguiculata*), pigeon pea (*Cajans cajan*) and lablab bean (*Dolichos lablab*) are inter-cropped or planted in alternation with local rice varieties, which are susceptible to Striga infestation.

1.1: Study question and justification

Poor yields of *Striga* infested upland rice are also associated with low and declining of soil fertility. A context analysis undertaken with farmers in four villages close to Lake Nyasa, in Kylea district (Mbeya Region) has indicated that infestations by *S. asiatica* have decreased rice yields from approximately 20 bags per acre 20 years ago to little more than 2 bags per acre today. A similar situation has been reported by farmer groups in two villages in the Ulugulu Mountains of Morogoro Rural District (Morogoro Region). Here, *Striga* is also a serious problem in maize, which is also an important food crop in the district. Although production can increase if inorganic fertilizer is used, high prices following macro-economic reforms (due to removal of subsidies) and limited availability due to poor accessibility grossly affects its use among poor households who depend on rice for food and income.

An alternative strategy is to improve the fertility of *Striga* infested fields by growing legumes in rotation with cereals. From initial trials with the green manure Marejea (*Crotalaria ochroleuca*) the farmer research groups in Kyela observed that rice performs in a similar way when planted following a crop of the green manure (*Crotalaria spp*) as it does when treated with urea at a rate of 50 kg N/ha. This practice therefore offers farmers a low cost approach to soil fertility enhancement to improve rice productivity on *Striga* infested soils. Pigeon pea is also known to increase soil nitrogen levels and is a well-known crop in both Kyela and the Ulugulu Mountains. Locally available varieties are however late maturing and susceptible to the wilt disease caused by *Fusarium udum*. Research work conducted by Ilonga Agricultural Research Institute has led to the selection of disease resistant cultivars, which have been favorably evaluated by farmers. The key activity involves a series of on-farm demonstrations, managed by farmers following training and with support from district extension staff and the project team. On-farm trials undertaken by farmer groups collaborating with NRI scientists under CPP funded project R7564 in Kyela demonstrated how rice yields can be increased by 25-50% by application of 25-50 kg Nitrogen ha^{-1} in the form of urea, while the infestation level of *Striga* is decreased.

Despite this realization and the fact that the majority of farmers are not however prepared to invest their limited cash in fertilizer, reception of the technology by farmers has been mixed and highly variable across households within the same village, between villages, and between study location. It is within this matrix that this study to establish a baseline information of the farming community in the two-districts was undertaken. This papers presents major findings of the study.

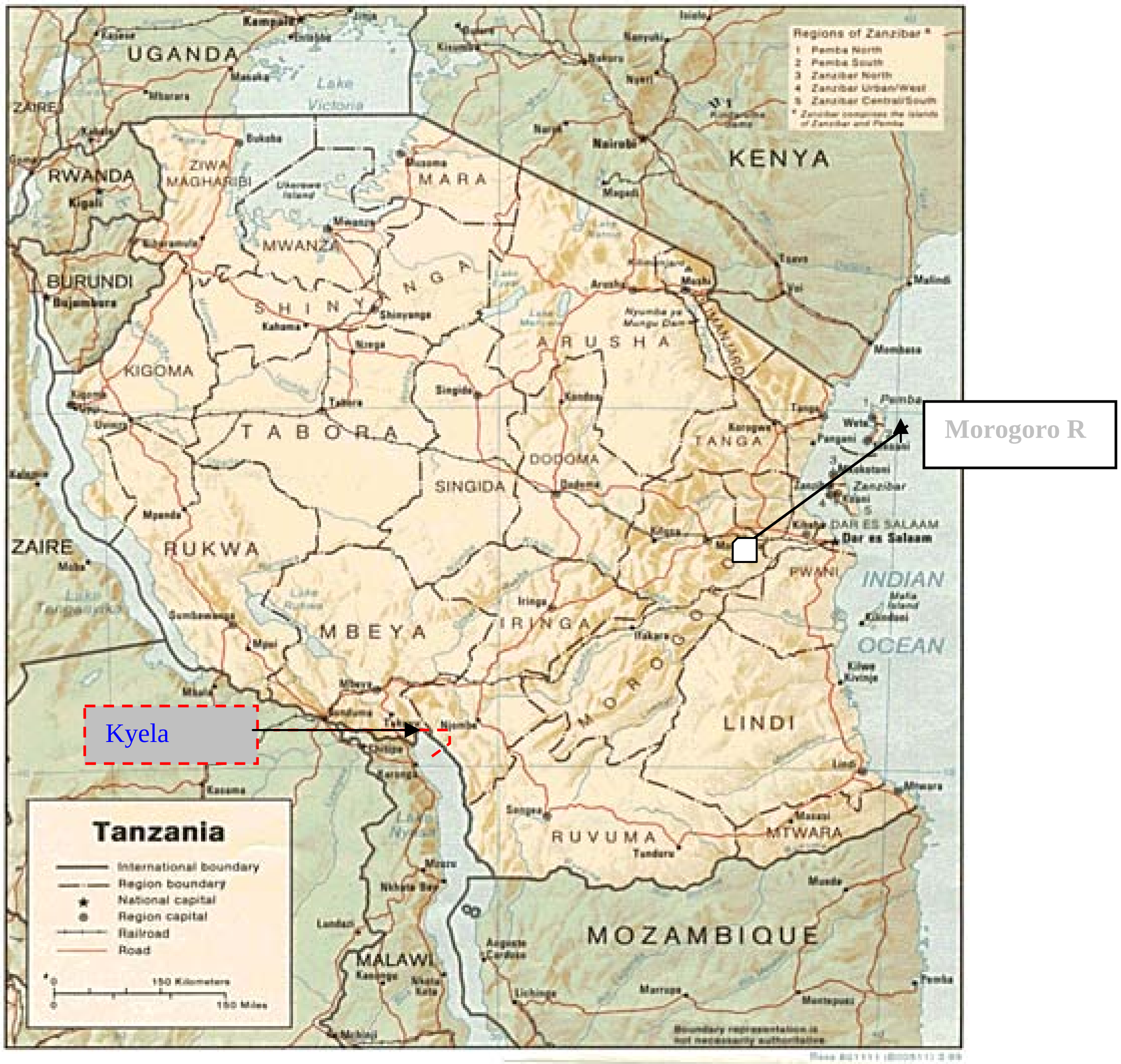
2.0 Methodology

2.1. Description of the study villages

The study was conducted in six villages (four in Kyela and two in Morogoro rural) in which a project "to enhance productivity of upland rice on Striga infested soils" is currently being implemented (see Map 1 for the locations). Four villages, Sinyanga and Konjula, Itope and Kilasilo in Kyela and two villages, Kiswira and Kibangile in Morogoro Rural were identified for conducting this promotional project. High incidences of parasitic weed *Striga* weed and marked decline in rice production were main reason for choosing these sites.

2.1.1 Kyela district

2.1.2 Matombo Morogoro rural district



Map 1: Map of Tanzania showing location of the study villages

2.2.Sampling and sample size

Both purposeful and random sampling methods were used in this study. Six villages involved in the promotional project were purposely chosen. In addition farmers involved in on-farm experiments were purposely included in the sample. Finally random sampling was used to identify farmers who are not involved in project promotional activities. The final sample size comprised of 177 respondents as per characteristics presented in Table 1.

Table 1: Household sample by village

Region/District	Village	Sample		
		Male	Female	Total
Mbeya (Kyela)	Kilasilo	24	10	34
	Itope	19	7	26
	Sinyanga	25	6	31
	Konjula	26	4	24
Morogoro (Morogoro rural)	Kiswira	15	14	29
	Kibangile	20	13	33
Total		123	54	177

SOURCE: Sample data, 2003.

2.3 Methods of data collection and analysis

Single visit structured questionnaire (see Appendix 1) was the principle method used in the data collection. The interview was conducted in March 2003. Observation and review of secondary data were also used to supplement data collected by questionnaire. Collected data were coded and analyzed by using SPSS computer program. Descriptive statistics such as frequencies, mean, and cross tabulation were used to analyze the collected data. In order to establish the contribution of specific variables on rice productivity in the study a regression analysis was employed. In this respect, quantity of rice produced and perception about *Striga* and soil fertility problem were independent variables, whereas several socio-economic factors such as age, family size, areas cultivated, ownership of assets such as land and cattle and locations – were independent variables.

3. Results and discussion

3.1.Household (*respondents*) characteristics

Table 2 presents some basic characteristics of the respondents. Respondents from different ethnic groups formed the sample which suggest that despite all are involved in rice production, cultural differences has high likelihood of influencing their production and investment strategies in their farms. The Nyakyusa and Luguru comprised the majority in Kyela and Morogoro districts respectively. Together they formed 66% of the respondents. Ndali accounts for 21% of the respondents while other tribes such as Yao, Zaramo, Nyamwanga, Ngoni, Nyiha, to mention few, accounted for the rest. High ethnic variability was higher in Kyela than in Matombo - Morogoro. For example, at Itope and Kilasilo, about 6 ethnic groups were recorded.

Table 2: Household characteristics of the sample`

	Kyela district				Morogoro district		Total sample (%)
	Sinyanga	Itope	Konjula	Kilasilo	KibangIle	Kiswira	
Tribes							
Nyakyusa	9	13	19	18	-	-	59 (33.3)
Luguru	-	-	-	-	32	26	58 (32.8)
Ndali	17	7	2	12	-	-	38 (21.5)
Yao	-	1	-	-	-	-	1 (0.56)
Zaramo	-	2	-	-	-	-	2 (1.13)
Nyaturu	-	-	-	-	-	1	1 (0.56)
Gogo	-	-	-	-	1	1	2 (1.13)
Nyamwanga	-	2	-	1	-	-	3 (1.69)
Kisi	1	-	-	1	-	-	2 (1.13)
Kinga	1	-	-	1	-	-	2 (1.13)
Ngoni	1	-	-	-	-	-	1 (0.56)
Nyiha	1	-	-	-	-	-	1 (0.56)
Fipa	-	1	-	1	-	-	2 (1.13)
Mambwe	-	-	-	1	-	-	1 (0.56)
None	-	-	3	-	-	1	4 (2.26)
Sex (%)							
Male	80.6	73.0	83.3	70.5	60.6	51.7	(69.5)
Female	19.4	27.0	26.7	29.5	39.4	48.8	(30.5)
Education level							
Adult	1	7	2	13	9	-	32 (18.2)
Primary	25	16	20	17	21	24	123 (69.4)
Secondary + course	5	3	2	4	3	5	22 (12.4)
Family size							
Total	4.35	6.5	4.25	6.00	6.53	4.72	5.43 {4.90}*
Above 14 years	2.4	3.15	2.08	3.00	3.42	3.20	2.90
Below 14 years	2.54	3.40	2.00	3.48	3.34	1.91	2.84
Age (mean)	38.1	49.8	33.1	48.1	44.1	42.6	42.8
Livelihood groups							
Poor	15	10	9	17	19	17	87 (49.2)
Medium	12	14	12	10	13	11	72 (40.6)
Well-off	4	2	3	7	1	1	18 (10.2)

SOURCE: Survey results, 2003.
* National average

Majority of the respondents (70%) were male farmers. Highest proportion i.e. above 80% was recorded in Kyela district and lowest in Morogoro district. Low proportion of male respondents in Morogoro does not explain high number of female headed households but rather due to the fact that during the period of interview males were involved in mining activities thus could not be interviewed. Data collected from the village office showed that female headed household account for 17% which is generally lower that the national average of 22%.

Family size is an important household characteristic in labour intensive rice farming systems. This study had revealed that each household has 5.4 members, which is slightly higher than the national average of 4.9 members (Population Census, 2002). Highest (≥ 6.3 members) family size was recorded at Itope in Kyela and Kibangile Morogoro district and lowest (≤ 4.3 members) at Sinyanga and Konjula in Kyela district. On average, the ratio between old and young members in the household was 1:1 and mean age of the household head was approximately 43 years with a range between 19 and 80 years. Konjula village had the youngest respondents.

Levels of education have a significant positive role in influencing adoption of a particular technology. Analysis of collected data revealed that 80% of the respondents have attended formal education. Highest proportion was recorded at Kiswira, Konjula and Sinyanga where more than 90% of the respondents have attended formal education. Kilasilo, Kibangile and Itope had highest illiteracy rate.

This study also intended to establish livelihood group of the respondents based on visual assessment when the respondents were interviewed on the type and quantity of capital assets such a house, cattle, farm equipment owned. Analysis shows that approximately 50% of the respondents are poor whereas only 10% belonged into high-income brackets. Majority of the poor were recorded in Morogoro district whereas Kilasilo village in Kyela district had high proportion of well-off farmers.

3.2 Ownership of capital assets

3.2.1 Livestock production

In smallholder agriculture livestock in general and cattle in particular play a significant role in crop production, income generation and in meeting some social and cultural obligations. In some other cases, livestock act as a store of wealth and important source of draught power (see Chilonda *et al*, 1999; Hella *et al*, 2003). Where availability of inorganic fertilizer is not feasible because of distance and prohibitive prices, farmyard manure (FYM) has been a reliable and cheap source of nutrients for crop production. Aggregation of data from this study has revealed that chickens are kept by all households in both districts. Average of 10 chicken per household was recorded with higher number in Kyela than Morogoro. Ownership of cattle was rather skewed than all other livestock. No household reported to keep cattle in Morogoro district where as in Kyela, average of 2.4 per household. Hilly terrain is the most likely reason, which limit cattle keeping in Morogoro district. Highest concentration (3.7 cattle per household) was reported at Itope village (Table 3). Other livestock kept though in smaller number include pigs, sheep, goats, and dogs.

Table 3: Average number of livestock raised per household in sample villages

District	Village	Pigs	Cattle	Sheep/goat	Chicken
Kyela	Sinyanga	0.5	1.8	0.0	11.1
	Itope	0.3	3.7	0.2	12.9
	Konjula	0.5	2.3	0.3	12.0
	Kilasilo	0.6	2.1	0.01	9.3
	District average	0.6	2.4	0.1	11.2
Morogoro (R)	Kibangile	0.0	0.0	1.3	4.3
	Kiswila	1.6	0.0	1.2	12.1
	District average	0.9	0.0	1.3	7.2
General average		0.6	1.5	0.5	10.1

SOURCE: Survey results, 2003.

Ownership of cattle has a close relation to methods used in land preparation. Table 4 indicates that about 90% of rice farmers in Kyela are likely to use ox-plough in preparing land for planting rice. In this sense it is generally easy for farmers in Kyela to plough-under the green manure than their counterpart in Morogoro district. In all villages flat seedbed was reported as the most common method of land preparation.

Table 4: Proportion of respondents by different methods of land preparation

Villages		Hand hoe	Ox-plough
Kyela	Sinyanga	10.0	90.0
	Itope	8.7	91.3
	Kilasilo	6.1	93.9
	Konjula	9.1	90.9
	District average	**8.5**	**91.5**
Morogoro	Kibangile	100.0	0.0
	Kiswira	100.0	0.0
	District average	**100.0**	**0.0**

SOURCE: Survey results, 2003.

3.2.2 Land ownership

Land is an important asset in smallholder agricultural systems since its ownership depict household security and to some extent wealth. In Tanzania land is owned by the state while the village governments are given a mandate to oversee its utilization. Average land owned by the household varies slightly across the study villages with an average of 4 acres per household. Lowest available land was recorded at Konjula in Kyela district (Table 5). On the other hand mean cultivated land was 3.4 acre which slightly less than available land. It is interesting to note that proportion of cultivated land to available land is higher in Morogoro than in Kyela district. There is evidence of serious land shortage is evidence in Konjula and Sinyanga villages. In such villages fertility improvement options involving intercropping (e.g. pigeon peas) are more likely to be adopted than those involving rotation (e.g. *Crotalaria*). Another important observation in analysis was the diversity of farm plots. On average, each household cultivates about three plots located in different ecological niche at an average of 20 minutes walking distance with range between 0 to 120 (2 hours). The observed diversity is important in smallholder farming systems as tends to maximize natural diversity although also tends to increase managerial cost. However the plot diversity and distance offers an excellent opportunity for extensive green manure than farm yard manure.

Analysis of survey data identified six type of land tenure. Inheritance was the most common land tenure systems in all villages surveyed except Kiswira in Morogoro district where leasing is dominant. About 30% of the respondents acquired their land through inheritance. Land acquisition through gift and purchase were respectively reported by 21 and 20% with highest proportion in Kyela than in Morogoro district. Borrowing though accounts only 10% of the whole sample, it is very common in Kilasilo and Konjula where more than 18% of the residents depend. In general, except borrowing and leasing, all other methods of tenure are secure in the sense that farmers can invest in fertility improvement without fearing that its ownership can change without prior notice.

Table 5: Characteristics of land ownership and tenure systems

	Kyela				Morogoro		Total
	Sinyanga	Itope	Konjula	Kilasilo	Kibangile	Kiswira	Average
No. of plots (mean)	2.4	2.7	3.0	3.4	2.2	2.4	2.7
Available (acre)	3.08	4.36	2.84	4.30	3.80	3.19	3.99
Cultivated (acre)	3.81	3.77	3.65	3.98	2.51	2.78	3.36
Balance	(0.73)	0.62	(0.81)	0.32	1.29	0.41	0.63
Land tenure system							
Inheritance	32.5	28.6	30.0	25.0	56.4	5.1	29.6
Village offer	9.6	9.5	7.5	7.1	3.5	7.1	7.5
Purchase	19.2	28.4	25.1	32.1	7.2	7.8	19.9
Borrow	19.3	4.9	10.5	3.6	18.4	12.5	11.5
Rent	0.0	0.0	0.0	0.0	0.0	60.5	10.1
Gift	19.4	28.6	26.9	32.2	14.5	7.0	21.4

SOURCE: Survey results, 2003.

Number in brackets ( ) means negative balance

3.3 Crop production

3.3.1 Type of crops grown

Table 6 presents a list of crops produced in Kyela and Morogoro district. Respondents were requested to rank crops according to their important. Consequently it was possible to identify the major and minor crops in their farming system. According the results, rice is the most important crop in Kyela whereas maize ranked highest at Morogoro. In Morogoro rice ranked second. Cassava and banana recorded similar rank in both districts. General observation show that crop diversity is higher in Morogoro than in Kyela despite of the fact that it has limited ethnic diversity compared to Kyela. High diversity in climate and land physical characteristics and the presence of diverse market opportunity in Morogoro and Dar es Salaam are the most likely reasons for the observed farming system in Morogoro ditsrict.

Table 6: Type of crops produced in study districts

Major	Rank	District	
		Kyela	**Morogoro**
Major crops	1st	Rice	Maize
	2nd	Maize	Rice
	3rd	Cassava	Cassava
	4th	Sweet potatoes	Sorghum
	5th	Banana	Banana
Minor crop	6 th	Cocoa	Sweet potatoes
	7 th	Pigeon peas	Pigeon peas
	8 th	Ground nuts	Tomato
	9 th	Bambara nuts	Citrus
	10 th	Oil palm	Coconuts
	11 th	Beans	Cowpeas
	12 th	Tomato	Sugar cane
	13 th	Citrus fruits	Yams
	14 th	-	Beans
	15 th	-	Cocoa
	16 th	-	Black pepper
	17 th	-	*Pilipili manga*

SOURCE: Survey results, 2003

Further to presentation on crop priority presented in Table 6 above, Table 7 presents a analysis of responses with respect to three crops ranked highest in two district. The analysis is based on the proportion of respondent who planted a crop in a particular plot. It was assumed that farmer's decision to plant a particular crop in a particular plot is a function of the value of the crop and the importance of a plot. With this assumption high value crop will be planted in the most important plot (i.e. plot 1) and vise versa. Based on the analysis (Table 7), all respondents (99.5%) in Kyela grow rice of which about 70% allocates into best available plot. In Kyela, about 88 and 87% indicated to grows maize and cassava respectively. These crops are located in lesser-valued plots than those earmarked for rice. On the other hand, 95% of the respondents in Morogoro grow maize and 50% of them plant on high value plot. Proportion of respondent growing rice and cassava was 69 and 71% respectively.

Table 7: Proportion of respondents by crop production priority and by district

Crop priority	Kyela			Morogoro		
	Rice	Maize	Cassava	Rice	Maize	Cassava
First	*69.3*	14.0	13.3	42.6	*50.8*	1.6
Second	20.9	*40.9*	28.7	*41.7*	35.0	6.5
Third	5.4	20.5	*28.6*	10.7	8.9	*28.6*
Fourth	2.0	4.0	13.9	4.8	-	2.4
Fifth	-	2.8	2.8	-	4.5	31.4
Sixth	1.9	3.7	-	-	-	-
TOTAL	99.5	87.9	87.3	68.8	94.5	70.9

SOURCE: Survey results, 2003.

Previous analysis has provided an opportunity to establish household characteristics with respects to the level of importance of rice farming household. Table 8 presents a number of household variables with respect to its importance categorized in three levels of priorities. Results reveal that variable related to family size acts negatively to rice production priorities suggesting that size of the household does not depict the need to increase rice production despite the role of human labour in production. Ownership of livestock, cattle in particular, is directly related with rice production priority. Members who indicated high priority have more than one cattle and vice versa (Table 8). Increased role of cattle in land preparation and provision of FYM are the most likely reasons to explain this phenomenon.

Table 8: Characteristics of respondents by rice production priority

Characteristic variables	Priority and variables		
	1st	2nd	3rd
Total family size (No.)	5.3	5.5	6.3
Total above 14 years old (years)	2.8	2.9	3.0
Total below 14 years old (years)	2.7	2.6	3.3
No. of cattle owned	1.7	1.6	0.1
No. of chicken owned	10.7	9.7	8.4
Bags of rice produced			
Bags of rice sold	5.7	3.5	1.1
Total land area owned (acres)	3.6	3.8	3.6
Total land area cultivated (acre)	3.4	3.6	2.9

SOURCE: Survey results, 2003

Other variables that correlated well with rice production priority include quantity sold and total cultivated area. Respondents have market-oriented production and who have large cultivated area indicated first priority than otherwise.

3.3.2. Rice productivity

As indicated earlier, a context analysis undertaken with farmers in four villages in Kyela district (Mbeya Region) has indicated that as infestations by *S. asiatica* increased rice yields have declined from approximately 20 bags per acre 20 years ago to little more than 2 bags per acre today (see Mbwaga and Rihes, 2003). Baseline study had revealed that actual yield, although is not at the level indicated during context analysis, but is generally lower than the national average. Differences across the two study districts and across farmers' level of knowledge[1] were apparent. Table 9 show that rice productivity (i.e. 12.6 bags of paddy /acre)[2] in Kyela district was twice as high as that at Morogoro. In Kyela, Kilasilo and Konjula recorded highest per unit production than other sample villages in the district. The difference in production between two study villages in Morogoro was negligible (Table 9).

Table 9: Paddy productivity by village, project group member and livelihood group

Variable group	Variable	Bags of rice/acre	
		Kyela	Morogoro
Villages	Sinyanga	13.9	-
	Itope	10.9	-
	Kilasilo	14.1	-
	Konjula	11.5	-
	Kiswira	-	7.6
	Kibangile	-	6.1
Marejea group	Yes	13.9	7.1
	No	11.5	6.6
Income group	Low	11.3	5.7
	Medium	11.5	8.2
	High	20.5	9.1
Average districts		12.6	6.9

SOURCE: Survey results, 2003.

Further, an attempt was made to establish the differences in productivity between farmers who are currently participating into fertility improvement project and income groups. Analysis showed that in all district project farmers recorded higher yield that non-project farmers, also high income farmers are likely to harvest twice as much yield as low income farmers in Kyela district. Almost similar trend was recorded in Morogoro district

[1] Based on whether participates or do not participate in on-farm research
[2] 1 bag of paddy = 80 kg

(Table 9). Since the project is in its inception stage, its role to influence the level of production observed was inconclusive.

Attempt to confirm the significance of some of the variable which were perceived to influence rice production was made by regression with level of production in 2001/02 season. The conceived model was expressed as;

$$\gamma=\beta(\alpha_1,.....,\alpha_2+\varphi)$$

Where: γ = Bags of paddy produced (dependent variables)

β =Constant

$\alpha_1,.....,\alpha_2$ = List of independent variable as specified in Table 10

φ = Error term

Table 10: Specification of explanatory variables for regression analysis

Variables	Abbreviation	Value measurement	Defined variable
Family size	α_1	Scale	Number
Education level	α_2	Ordinal	1= adult education, 2=primary education, 3= secondary plus courses
Livelihood group	α_3	Ordinal	1=poor; 2=medium; 3= rich
Marejea research member	α_4	Nominal	1=yes; 2=no
Number of cattle owned	α_5	Scale	Number
Total area cultivated	α_6	Scale	Number
Land preparation methods	α_7	Nominal	1=hand hoe; 2=ox-plough
Number of plots owned	α_8	Scale	Number
District	α_9	Nominal	1=Kyela; 2=Morogoro
Constant	β		

SOURCE: Authors' estimates

Results of regression estimation are presented in Table 11. Adjusted R^2 was 0.62 denoting that independent variable explained about 60% of the total variation in yield of rice in the study area. Other 38% are explained by other variables such as rainfall, soil fertility etc. which was not included in the model. Based on F-statistics, (9.129) the estimated model was significant at p=0.01. Family size, education level, number of cattle owned, and number of plots - positively influence yield of paddy. This relationship denotes that increase in either of these variables is associated with increase in yield.

However, all these variables were not significant at p=0.1 level. . Evidence from the study suggests that area expansion and to some extent household livelihood group have positive influence on yield and highly significant at 0.01 and 0.05 levels respectively. However with the observed land shortage in all study districts area expansion is less likely to be sustainable for much longer, hence in this situation the use of green manure is likely to offers the best option. Analysis of the results showed that production is negatively associated respondents' participation in a project and the district of residence. Based on variable definition presented in Table 10 the observed negative association suggest that output is high with project participation and with Kyela district. These variables were significant at p-0.01 and p=0.1 levels. Variable - method of land preparation - was negatively associated with yield explaining the limitation of use of hand hoe in rice production.

Table 11: Socio-economic factors affecting rice production

Variables	B	Std Error	t –statistics	Sig. level
Family size	0.166	1.771	.094	.925
Education level	4.164	7.387	.040	.574
Livelihood group	14.108	6.606	2.136	.035**
Marejea research member	-14.216	8.016	-1.773	.078*
Number of cattle owned	2.361	2.076	1.137	.257
Total area cultivated	8.185	1.811	4.519	.000***
Land preparation methods	-4.515	14.756	-.306	.760
Number of plots owned	.562	3.340	.168	.760
District	-25.982	15.432	-1.684	.095*
Constant	64.156	45.982	1.395	.165
Adjusted r^2			0.619	
F-statistics			9.129	.000***

SOURCE: Calculated from survey data

*; **; ***; = Significant at 0.1; 0.05; and 0.01 respectively

3.3.3. Major constraints in rice production

Farmers were later asked to give their views on type(s) of constraints facing rice production in the study area. Table 12 presents proportion of the respondents by type of constraint in the study districts. The analysis shows that decline in soil fertility, *Striga* infestation, weed and rainfall variability ranked highest. Although the proportion of respondent was highest in Morogoro region, but the difference with Kyela was negligible (see Table 12). Analysis of the problems according to household characteristics is presented in Table 13.

Table 12: Main constraints in rice production

Constraints in production	Districts (%)		Total response	
	Kyela	Morogoro	Frequency	%
Declined soil fertility	24.6	25.0	42	24.7
Striga infestation	22.8	23.2	39	22.9
Weed infestation	18.4	21.4	33	19.4
Rainfall variability	6.1	10.7	13	7.6
Pests and diseases	7.9	5.4	12	7.1
Lack of farm implements	5.3	8.9	11	6.5
High prices for farm inputs	9.6	0.0	11	6.5
Poor cultural practices	4.4	0.0	5	2.9
Land problem	0.0	3.6	2	1.2
Market problems	0.9	0.0	1	0.6
Bird attack	1.6	0.0	1	0.6

SOURCE: Survey results, 2003.

With respect to specific problems, proportion of responses was lower among project than non project farmers. Relationship between livelihood group and rice production constraints was slightly varied. For example while majority of the high income household indicated soil fertility and poor husbandry practices as the most limiting problems, Striga, rainfall variability and high input prices were mostly mentioned by poor farmers. Difference across livelihood groups for constraint such as weed infestation was not realized.

Table 13: Major constraints in rice production by *Marejea* and livelihood group

Constraints in production	Marejea group		Livelihood		
	Yes	No	Low	Medium	High
Declined soil fertility (n=42)	47.6	52.4	21.0	23.9	44.4
Striga infestation (n=39)	43.6	56.4	22.2	26.8	11.1
Weed infestation (n=33)	48.5	51.5	22.2	15.5	22.2
Rainfall variability (n=13)	46.2	53.8	11.1	5.6	0.0
Pest and diseases (n=12)	41.7	58.3	7.4	7.0	5.6
Lack of farm implements (n=11)	30.0	70.0	3.7	9.9	5.6
High prices for farm inputs (n=11)	45.5	54.5	8.6	4.2	5.6
Poor cultural practices (n=5)	40.0	60.0	0.0	5.6	5.6
Land problem (n=2)	0.0	100.0	2.5	0.0	0.0
Market problems (n=1)	0.0	100.0	1.2	0.0	0.0
Bird attack (n=1)	100.0	0.0	0.0	1.4	0.0
TOTAL	44.4	55.6	100.0	100.0	100.0

SOURCE: Survey results, 2003.

4: Conclusion and recommendations

The main objective of this study was to identify important social and economic variable explaining production and productivity of paddy in Kyela and Matombo - Morogoro rural district so that baseline reference can be established. Based on the findings presented in the subsequent section, the following conclusions can be established.

- Rice is an important food and cash crop in the study area. However the importance vary between the two districts. It is most important crop in Kyela than in Morogoro district.
- In all districts, rice is produced under subsistence scale with majority in plots less than two hectare using local varieties and simple production tools
- Yield is generally lower than average, but there is huge variation between households within villages or districts, and between districts. Factors such as income, ownership of capital assets, land availability, and knowledge were considered to be important explanatory in rice production
- Declining soil fertility, weed infestation including Striga, and rainfall variability are the most important problems in all study districts with slight differences in level of perception about the problem across the livelihood groups

Based on these conclusions this study recommend for both technology and people centered approach in disseminating technologies intended for enhancing productivity of upland rice on *Striga* infested soils in Kyela and Matombo – Morogoro rural districts.

5.0 List of Reference

Chilonga, et al (1999). Economic factors affecting up-take of veterinary services in selected villages in Zambia. *Outlook in Agriculture.*

Doggets, H. (1980). *Sorghum* John Wiley and Sons, New York. 403pp

Hella, J.P.; G. Vam Huylenbroeck and M.E. Mlambiti (2003). Linking Rainfall Variability and Soil erosion problems in semi-arid Tanzania. *Journal of Sustainable Agriculture.* Vol 2(1) 9-19pp.

Mbwaga, A.M. and C. Riches (2003). Monitoring Demonstrations of Soil Fertility Enhansing Practices: Kyela and Morogoro rural districts. Project (R8194) working paper No. 3, Natural Resource Institute (UK) and ARI Ilonga (Kilosa).

Mloza-Banda, H.R.; and V.H. Kabambe (1996). Integrated Management for Striga control in Malawi. African Crop Science, 4(2): 263-273.

Population Census (2002) Preliminary report, Tanzania bureau of statistics, Dar es Salaam

Ransom, J.K.; G.D. Odhiambo; G. Abayo; and A. Osward (`997). An update on *Striga* control research in Africa. *In* Proceedings of the 16th Biennial Weed Science Society for Eastern Africa. 215-221pp

Sibuga, K.P.; C.L. Rweyemamu; J.C. Kwacha; E. Kimambo; D. Mwaseba; and A.K. Mbwana (2002). Preliminary results from on-farm trails on witch weed (*Striga spp.*) management. A paper presented at the 2nd MAFS/SUA Collaborative Research workshop on Food Security.

PLANNING MEETING/WORKSHOP IN MATOMBO AND KYELA FOR ACTIVITIES 2003/04 SEASON

Project R8194 (ZA0511)
Working paper No 7

A. M. Mbwaga-ARI Ilonga

January 2004

Project Team Members participated on the review of the results and planing 2004:
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Mr Mwambungu – District Agricultural and Livestock Development Officer
Mr Mwampaja – Village extension worker
Mr Mwangosi – Village extension worker

In Morogoro Rural:

Ms. Masangya – District extension officer
Mr H. Kisumo – Village extension worker

Cover page
Left :Crotalaria at vegetative stage
Right: planted with cassava

Matombo teachers at planing activities for 2003/2004 cropping season

Preface

Striga species, the parasitic witch-weed, are wide spread in small holder crops in semiarid and sub-tropical regions of Eastern and Southern Africa. These weeds attack and reduce the yield of maize, sorghum, upland rice and finger millet in these regions. In many areas it is the crops of resource-poor households, which are particularly affected. They impose additional stress with which farmers, who have little resources for investments in crop production, have to cope in an environment characterised by marginal rainfall for cropping and declining soil fertility.
Since 1996 staff from the Department of Agricultural Research Development, Sokoine University of Agriculture and Extension in Tanzania and, Natural Resources Institute in UK have collaborated to develop integrated Striga management practices for rice crop. Studies have been undertaken with groups of rice farmers in Kyela district, in the Southern Highlands of Tanzania.
Through on-farm trials farmers came to appreciate that Striga infestation and poor rice production are associated with and indicators of low soil fertility. This in turn is a consequence of continuos rice cultivation in the absence of using any fertilizer or manure. While the field trials demonstrated that up to a 60% reduction in Striga numbers and a 40% increase in rice yield is achieved by using urea fertilizer, farmers decided they did not wish to invest scarce cash in fertilizer. Instead they became interested in the opportunity, also observed from the field trials, to improve rice productivity on Striga infested soils by introducing the green manure crop *Crotalaria.*

The current project is on "*On-farm verification and promotion of green manure for enhancing upland rice productivity on Striga infested fields in Tanzania*". It is operating from October 2002 to March 2005 with aims to scale up the demonstration of using the green manure in rotation with rice in both Kyela (Mbeya Region) and Matambo (Morogoro Region).

The purpose of this report is to outline the activity performance on the project, which involved end season group evaluation of demonstration plots results, which were planted in the 2003 rice-growing season and planing for the 2004 cropping season.

Further information on the project or further copies of previous reports are obtainable from:
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Executive summary

Continuous cultivation of upland rice in southern Tanzania without using manure or fertilisers has led to a decline in soil fertility and build up of witchweed (*Striga asiatica*). This parasitic weed thrives in soils deficient in nitrogen growing on the roots of the rice plants that become stunted and produce a poor harvest. Yields have fallen from 10 to 2 bags per acre over the past 20 years as witchweed levels have increased. This project is promoting the use of the green manure *Crotalaria* (called *marejea* in kiswahili) and/or *Fusarium udum* resistant pigeon pea cultivars to reduce witchweed populations, enhance soil fertility and increase rice yield. This builds on the outputs of CPP project R 7564 by undertaking on-farm demonstrations with village communities in Kyela and Morogoro Rural districts and other promotion activities through village primary schools in these areas.

47 demo plots were established in Kyela and in Matombo in 2003. Yields of rice in 2003 at sites in Kyela, planted with either *Marejea* or pigeon pea in 2002 season increased by 4-fold. There is an increasing demand for farmer produced *Marejea* seed. Kyela farmers have sold 240 kg at 600 Tsh/kg. The project facilitated an exchange visit for farmers from Matombo to see demonstrations in Kyela. This has motivated Matombo farmers to plant green manure on a larger scale in 2004 with many more farmers joining the farmer groups evaluating and demonstrating the practice. Soil analysis indicated very low levels of N and P in Kyela soils. Observation demo plots in 2004 has indicated considerably improved vigour of rice following application of locally available Minjingu Rock Phosphate. The Kyela district organized a field day for farmers attended by District commissioner, District Director and District Councillors and they were impressed by the effect of *Marejea* on rice yield and promised to upscale the technology to other villages.

1.0 Introduction:

Poor yields of *Striga* infested upland rice are associated with low and declining soil fertility. A context analysis undertaken with farmers in four villages close to Lake Nyasa, in Kyela district (Mbeya Region) has indicated that as infestations by *S. asiatica* have increased rice yields have declined from approximately 20 bags per acre 20 years ago to little more than 2 bags per acre today. A similar situation has been reported by farmer groups in two villages in the Uluguru Mountains of Morogoro Rural District (Morogoro Region). Here, *Striga* is also a serious problem in maize, also an important food crop in the district. On-farm trials undertaken by farmer groups collaborating with CPP funded project R7564 in Kyela demonstrated how rice yields can be increased by 25-50% by application of 25-50 kg Nitrogen ha^{-1} while the infestation level of *Striga* is decreased. The majority of farmers are not however prepared to invest their limited cash in fertiliser.

An alternative strategy is to improve the fertility of *Striga* infested fields by growing legumes in rotation with susceptible cereals. From initial trials with the green manure Marejea (*Crotalaria ochroleuca*) the farmer research groups in Kyela observed that rice performs in a similar way when planted following a crop of the green manure *Crotalaria* as it does when treated with urea. This practice therefore offers farmers a low cost approach to soil fertility enhancement to improve rice productivity on *Striga* infested soils. Pigeon pea is also known to increase soil nitrogen levels and is a well-known crop in both Kyela and the Uluguru Mountains. Locally available varieties are however late maturing and susceptible to the wilt disease *Fusarium udum*. Work by Ilonga Agricultural Research Institute has led to the selection of medium duration, disease resistant lines, which have been favourably evaluated by farmers. With project R7564 due to end in March 2003 it was decided to scale-up promotion of legumes used in rotation with rice to enhance soil fertility of *Striga* infested land. The current project is therefore undertaking promotion work in four villages in Kyela, including the two where on-farm trials were on-going, and has extended activities to two villages in the Uluguru mountains. The key activity involves a series of on-farm demonstrations, managed by farmers following training and with support from district extension staff and the project team. This report summarises observations made after harvest of demonstrations planted in the 2002/03-crop season. Poor performance of the plots in Matombo was caused by draught, which prevailed during the growing season

2.0 Objective:

Presentation of results for 2003/04 season
Agree on the demonstration sites for the cropping season of 2003/04

3.0 MOROGORO DISTRICT
3.1 Kibangile village

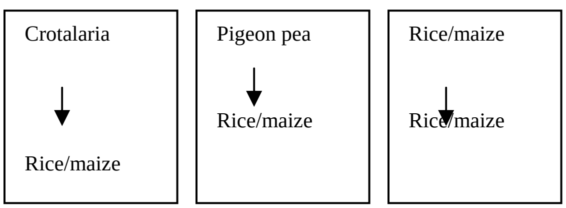
The meeting was opened officially by the district officer after the introduction of new participating farmers. The District officers called upon farmers to prepare themselves for the coming cropping season which is about to start. She reminded them the weather problems that affected the performance of the trial last time, and other technical problems realized in the establishment of the trial. She also argued those farmers who participated in farmer exchange visit in Kyela District to be in the fore front in putting into practice, and teach others what they learned in Kyela.

Project leader thanked the farmers for attending the meeting and their hospitality. Then participants introduced themselves and there were 13 new members

Farmers were reminded problems and challenges that necessitate the introduction of *Crotalaria*. Problems were depletion of soil fertility, presence of *Striga*, poor agronomic practices and draught cause by unreliable rains. These problems resulted into very low yield s of rice and maize. Therefore, the challenges were to raise rice yield from 2 to 20 bags rice and maize yield from 2 to 10 bags

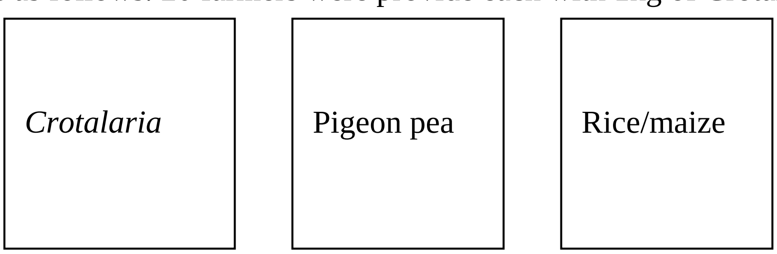
Farmers were reminded the biology of *Striga* and available control options including hand weeding, application of farmyard manure, the use of *Crotalaria* and the use of pigeon pea. The group agreed to continue control *Striga* by improving soil fertility using *Crotalaria* and pigeon pea.

Last season the trial layout was as shown below, where *Crotalaria*, pigeon pea and rice or maize were planted. The following season all plots will be planted with rice or maize as shown by the arrows.



Six farmers will participate in the first experiment where four will plant maize and two will plant rice. Farmers were requested to observe and record weed infestation (number of weeding per season, number of *Striga* plants in 5x5 m^2 and grain yields per plot.

It was agreed that cropping season 2003/04 plot size will be 10 x $35m^2$ and the lay out will be as follows. 20 farmers were provide each with 1kg of Crotalaria



In addition, it was agreed that planting of *Crotolaria* and pigeon pea would be done in January/February depending on the onset of rainfall. This means the trial must be planted in January/February. Farmers were advised to broadcast *Crotalaria* heavily so as to realize weed suppression, while for pigeon pea spacing will be 120 x 30 cm and they can have maize planted inter row as inter-crop

The District officer closed by calling upon farmers to educate their families about the use of *Crotalaria* and pigeon pea to fertilize soil and control *Striga*. This will be the responsibility of each farmer and not the extension officer. Farmers were requested to try to their capacity to show what they learned from their fellow farmers who participated in the exchange visit. She suggested that individual farmers must have their targets and make sure that they reach their targets, at the same time they must assist each other to goals. Finally they were requested to keep the group integrity, and a group must cater for other social activities.

3.2 Kiswira village (Tuwalole FRG)

Farmer group Chairman opened meeting at 0915
Self-introduction was done for participants including 10 new members.
Then farmers presented results in their progress report, which was read by the group secretary. (See Appendix……..)

The District officers introduced the facilitators

The reminded farmers problems and challenges that necessitate the introduction of *Crotalaria*. Problems were depletion of soil fertility, presence of *Striga*, poor agronomic practices and draught cause by unreliable rains. These problems resulted into very low yield s of rice and maize. Therefore, the challenges were to raise rice yield from 2 to 20 bags and maize yield from 2 to 10 bags

Farmers were reminded the biology of *Striga* and available control options including hand weeding, application of farmyard manure, the use of *Crotalaria* and pigeon pea.

The trial layout for the past season was as shown below

Crotalaria	Pigeon pea	Maize/Rice

Then the second season all plots which were under *Crotalaria* or pigeon pea will planted with maize/rice. (?????? the number of farmers provided with maize seeds) Farmers will observe weed infestation including *Striga* incidence and crop performance in terms of yield. Therefore, data to be collected will be weed infestation (number of weeding per season), number of *Striga* plants in 5x5 m^2 and grain yields per plot.
It was agreed that cropping season 2003/04 the lay out would be as follows

Crotalaria	Pigeon pea	Maize/Rice

Planting of *Crotalaria* and pigeon pea will be done in January/February depending on the onset of rainfall, and the trial must be within their own fields. Farmers were advised to broadcast *Crotalaria* heavily so as to realize weed suppression, while for pigeon pea spacing will be 120 x 30 cm and can be intercropped with maize. The plot size will be 10 x 15m^2. Participating farmers were issued 20 pocket 1kg of *Crotalaria* and 25 pocket 0.5kg of maize (TMV1)

The District officer closed by calling upon farmers to educate their families about the use of *Crotalaria* and pigeon pea to fertilize soil and control *Striga*. This will be the responsibility of each farmer and not the extension officer. Farmers who participated in the exchange visit to Kyela were requested to educate their fellow farmers on what they learnt. She suggested that individual farmers must have their targets and make sure that they reach their targets, at the same time they must assist each other to reach the goals. Finally they were requested to keep the group integrity, and that a group must cater for other social activities to make it live.

4.0. KYELA DISTRICT

4.1 Itope village

The Farmer Research Group chairman opened the seminar at 1025 hrs. He apologised for delaying to start the meeting.

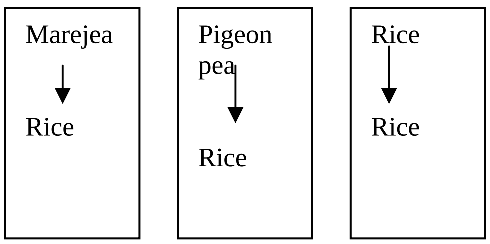
DALDO of Kyela District welcomed the participants, then followed a self-introduction of farmers and facilitators. He emphasised active participation and to be on time in attending meetings. There was one new participant.

The Project leader gave an outline of *Striga* cycle as a reminder, its effect on crops and control strategies. Control measure can take as long as 15 years. He presented last year's results that showed that the effect of *Crotalaria* / pigeon pea on *Striga* incidence and yield of rice. Plot that had *Crotalaria* previous year produced higher rice yield than plots that had rice in consecutive years for two of the farmers. *Striga* count was also much lower than those plots rice followed after rice (Appendix 2)

The soil scientist, presented an outlined in general terms the soil fertility status of Kyela soils. Participants were informed that soils were low in Nitrogen and phosphorus contents. Strategies to improve nitrogen and phosphorus deficiency included use of *Crotalaria* and Minjingu phosphorous rocks that are locally available in Tanzania. Other strategies include use of urea and Di-Ammonium Phosphate fertilisers. In addition the soil had low pH (an average of about 4.5) which can also be ameliorated by Minjingu Phosphate Rock

During the meeting, preliminary findings of the baseline study, which was conducted in March 2003, were also presented. In Itope village, 26 farmers were interviewed whereby 7 were females and 19 males. Generally, yield levels are low. For example in good years some farmers can harvest up to 16 bags per acre and bad years 1.5 bags .The average yield is 11 bags which is a reasonable yield compared to other villages. Main problems observed and proportion of respondents in percentage include depletion of soil fertility 25%, *Striga* infestation 25%, Weeds infestation 18%, Unreliable rainfall 8%, Diseases and pests 7%, High prices of inputs 3% and Birds 2%. These results show that *Striga* infestation, depletion of soil fertility and weed infestation is major problems hindering rice production. Therefore, it justifies the use of *Crotalaria* in the control of *Striga* and improvement of soil fertility. At the same time, the Crotalaria fallow can reduce the infestation of other weeds. For more detail, refer working paper No. 5 (2003).

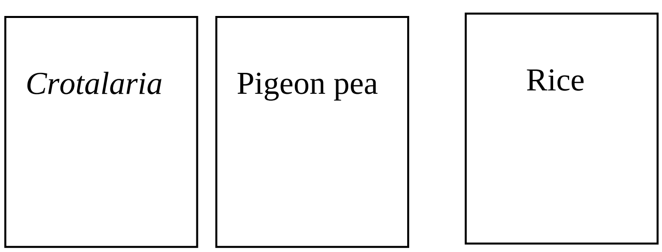
Field planning for the next season,
The plots that were planted *Crotalaria*, pigeon peas and rice in 2002/2003 will be planted rice in 2003/2004 as indicated in diagram below.



Farmers were advised to observe *Striga* incidence, weeding frequency and rice crop performance.

For 2003/2004 farmers will have to establish three plots of 30 by 15 metres and they are supposed to plant their trial by December/January. Plot arrangement was proposed as presented by a diagram below. It was agreed that old members would use their own seed while new members will buy seed from their fellow farmers. Project will provide pigeon pea seed to 30 farmers.

Experiment 2 2003/04



The draft of leaflet titled "*Rutubisha udongo na Dhibiti viduha kwa kutumia Marejea*" was distributed to farmers so that they can read and make comment on the relevance and the easiness to understand. Then the research group chairman was presented by the project a new bicycle to enhance co-ordination of the group activities. The DALDO presented the bicycle on behalf of the project.

The research group chairman thanked the project and informed that in the forthcoming season the group has decided to cultivate 2 acres of which half will be planted *Crotalaria* and another half rice. Then the Chairman closed the meeting at 12.45pm.

4.2 Kilasilo village

The group chairman opened the meeting at 10:00am. He introduced the facilitators, then general introduction of farmers where five were new participants. About 26 member attended the meeting. The chairman gave a short progress report of the activities of the group (see appendix 3).

Main observation noted was increase in yield in experimental plots. Plots that had *Crotalaria* the previous season had mean yield of rice of about 7.5 kg/ 25 square metre while the rice – rice plots yielded 3kg / 25 square metre. Pigeon pea was also experimented but only two farmers attempted the experiment which also gave an average of 8.3 kg per 25 square metres compared to 3kg / 25 square metre in rice-rice plots.

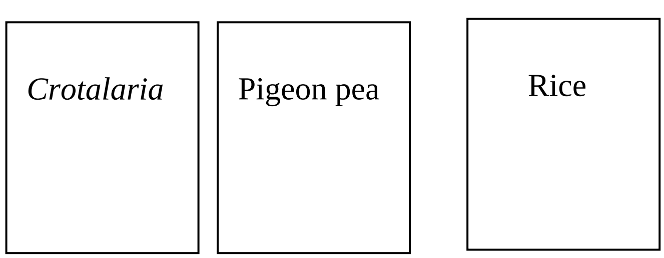
Experimental results for 2002/2003 was also presented. Initially the life cycle of the S*triga* was outlined to remind continuing farmers and teach new farmers. He showed the species, control strategies were also explained including the use of *Crotalaria*. He presented data for Kilasilo showing the effect of *Crotalaria* and pigeon pea on *Striga* incidence and yield of rice. *Crotalaria* and pigeon pea reduced *Striga* number and increased rice yield (Appendix 3). Two farmers tried pigeon pea while 18 farmers tried *Crotalaria* and pigeon pea.

Then soil scientist outlined fertility status of the soils of Kilasilo. It was noted that the soils were low in nitrogen and phosphorous content. They were also strongly acidic (pH between 5 and 4.5) The corrective measures included use of urea and *Crotalaria* for nitrogen and TSP and Minjingu phosphate Rock for phosphorous. It was decided to try Minjingu Phosphate Rock to improve P status and decrease acidity. Five farmers will be selected to try this product during the coming season

Preliminary findings of the baseline study, conducted in March 2003, were presented in this meeting. In Kilasilo 34 farmers were interviewed among them 10 were females and 24 males. Generally, yield levels are low. But results show that in good years some farmers can harvest up to 11 bags per acre and bad years they harvest nothing. The average yield is 3.1 bags. Some problems were identified hindering rice production these include depletion of soil fertility 7.6%, *Striga* infestation 35.3%, Weeds infestation 11.8%, unreliable rainfall 2.6%, high prices of inputs 23%, poor market 2.9% and poor farm implements (working paper No. 5, 2003).

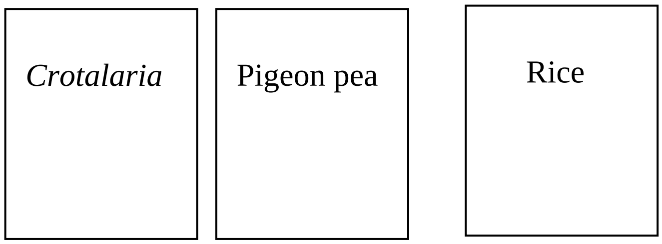
Planning for the coming season

Experiment 1 2002/03



Then all were are planted with rice for comparison purposes, the following data was collected rice yield, weeding frequency and *Striga* count in a 5 x 5 m^2 area.

Experiment 2 2003/04



The plot size will 10 x 35m^2
Leaf let titled "*Rutubisha udongo na Dhibiti viduha kwa kutumia Marejea*" in a draft form was distributed to farmers so that they can make their comments for the final draft. Each farmer got a copy.
The Chairman closed a meeting at 1300hrs

4.3 Konjula village
The Chairman opened the meeting at 1100hrs, there was a poor attendance because farmers had other religious commitments.

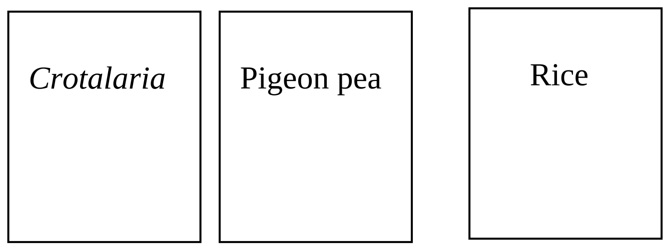
There was a self-introduction to all participants farmers and facilitators.

The Project leader outlined the biology of *Striga*, its effect on rice and some strategies of its control or management. This was to recap the previous season sessions and introduce the topic to new participants. In his explanation, he clarified the roles of *Crotalaria*, pigeon pea and urea.

It was raised that young farmers are not willing to improve soil fertility using *Crotalaria* because they do not owned the land. They normally rent from other people who normal break contract, when see that young farmers have obtained high yields due to improved soil fertility.

During this meeting, preliminary findings of the baseline study done in March 2003 were presented. The total number of 24 farmers was interviewed in Konjula village among them 4 were females and 20 males. Generally, yield obtained are low the average yield is 9.3 bags where it ranges from 2 bags to 22.3 bags. Main problems observed and proportion of respondents in percentage include depletion of soil fertility 37.5%, *Striga* infestation 16.7%, Weeds infestation 16%, Unreliable rainfall 8.5%, Diseases and pests 4.2%. These results show that *Striga* infestation, depletion of soil fertility and weed infestation is considered major problems hindering rice production. Therefore, there is a strong justification of using *Crotalaria* in the control of *Striga* and improvement of soil fertility. Infestation of other weeds can be reduced by the *Crotalaria* fallow (working paper No. 5 2003).

Planning for next season Experiment 1 2002/03



In 2003/04 all plots to be planted with rice. Farmers were requested observe the incidence of Striga and the performance of the rice crop where the following data will be collected rice yield, weeds and weeding frequency and *Striga* incidence

4.4 Sinyanga village

The chairman opened the meeting at 0930hrs.
Project leader apologised for the confusion in change in dates for this seminar. He emphasised the importance of women participation because the messages are for the whole household not men only.
He reminded farmer the life cycle of *Striga* its effect on rice production and some control strategies.
Preliminary findings of the baseline study, which was conducted in March 2003, were also presented during this meeting. 31 farmers were interviewed in Sinyanga village where 6 were females and 25 males. Generally, yield levels are low. Farmers who participate in the project obtain an average of 9.7 bags and 8.7 bags for non-participating farmers respectively. Main problems observed and proportion of respondents in percentage include depletion of soil fertility 10%, *Striga* infestation 16.7%, weeds infestation 26.7%, unreliable rainfall 6.7%, diseases 23.3%, high prices of inputs 3.3%, poor cultivation practices. It is only in this village where disease was identified as a major problem, this is associated with the outbreak of Rice Yellow Mottle Virus (RYMV) in the previous seasons. The problem of *Striga* infestation, weeds and depletion of soil fertility justifies the use of *Crotolaria.* For more detail, refer working paper No. 5 (2003).

Appendix 1: **.Progress Report from Tuwalole Farmer Research Group Kiswira- Matombo Morogoro Rural**

Group Formation: 18 participants formed the group in 2002.
Success:

- Through activities of *Striga* control by *Crotalaria* the group attracted a number of participating farmers. This resulted into 10 new members.
- The group have started raising fund for the purpose of forming a Credit society

Results of the trials visited by the secretary of the FRG.

Name of the farmer	Yields in kg/25m^2		
	Pigeon pea	Crotalaria	Maize*
Otto Mzeru	1.5	0.5	0
George Mkami	0.5	0.5	2.0
Albertina Thomas	1.5	0.5	0
Michael Roman	2	0.5	0
Adolf Mawango	1	1.0	0
Isdori Maliniu	0	10.0	0
Total	**6.5**	**13.0**	**2.0**

*Crop affected by draught

Problems encountered:

- Draught
- Pigeon peas suffered from a disease
- Lack of seminars for group leaders to enable them to carry their responsibilities
- Lack of agriculture implements
- Lack of capital in the group

Requests:

- Due to the continuing draught we need to be provided with early maturing maize variety
- We need to be assisted with technical know how in the formation of Credit Society
- Loans to buy purchasing agriculture inputs

Appendix 2:Itope Village Results from demo plots for the 2003 cropping season

Sites	Striga count/25m^2			Grain yield kg/25m^2		
	Rice after rice	***Rice after Marejea***	***Rice after pigeon pea***	***Rice after rice***	***Rice after Marejea***	***Rice after pigeon pea***
Rehema Mwalaba	48	18	-	-	9.5	-
Laison Kayuni	-	2	-	-	6.0	-
Y. Kayuwi	-	0	-	-	1.5	-
Mbalangwe	-	0	-	-	4.5	-
Mwema Hamisi	8	0	5	2.5	9.0	2.5
A. Mwakitubwa	-	0	0	-	3.0	3.0
Mwang'onda	12	5	-	2.0	4.0	-
Mean	**10.0**	**4.2**	**2.5**	**2.3**	**5.8**	**2.7**
Yield increase %				**0**	**140**	**17.4**
Range	**8-48**	**0-18**	**0-5**	**2-2.5**	**1.5-4.5**	**2.5-3.0**

** planted with rice variety Supa, *planted with rice variety Zambia

Appendix 3: Evaluation on the impact of planting rice after Crotalaria/pigeon pea on Striga numbers and rice grain yield Kilasilo village 2003

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Sites	Striga count/25m^2			Grain yield kg/25m^2		
	Rice after rice	***Rice after Marejea***	***Rice after pigeon pea***	***Rice after rice***	***Rice after Marejea***	***Rice after pigeon pea***
Mwandenuka	1.0	1	-	0.5	6.0	-
Mwamundela	181	160	86	4.5	8.0	9.5
Mwakalinga	1300	82	-	1.5	4.5	-
Mwakatage	0	18	-	2.0	4.0	-
Kandonga	2100	396	-	3.5*	2.5**	-
Mwaipopo	15	5	1	2.5	10.0	7.0
Mwaseba	126	31	-	3.0	4.0	-
Frora Samwilo	77	103	-	3.0	6.5	-
Mbonge	-	-	-	-	-	-
Mwandenuka 2	63	177	-	2.1	3.0	-
Sankey	396	704	-	3.5*	3.5	-
Isumo	15	47	-	4.0	7.0	-
Mugogo	2	0	-	2.2	2.5	-
Mean	**214.3**	**285.7**	**43.5**	**3.8**	**5.1**	**8.3**
Yield increase %				**0**	**34.2**	**118.4**
Range	**0- 2100**	**0 -704**	**1 - 86**	**0.5 – 4.0**	**2.5 – 10.0**	**7.0-9.5**

** planted with rice variety Supa, *planted with rice variety Zambia

Combined analysis: for Kilasilo

Treatment	**Striga count/25m^2**	**Rice yield t/ha**
Rice after rice	198	3.5a
Rice after Crotalaria	121	7.2b
Rice after pigeon pea [a]	8	2.0a
Mean	**108.8**	**4.00**
SE	**255.9**	**0.67**

[a] Only two farmers had a treatment of rice after pigeon pea

Appendix 4: Effects of green manuring on soil properties and Striga infestation

G. Ley

Introduction

Upland rice production in Kyela district is limited by *Striga*, a parasitic weed that attaches itself to the rice roots where it draws its moisture and nutrients requirement, inhibiting plant growth, reducing yields and in severe cases causing plant death. The high Striga infestation in Kyela soils has been associated with reduced soil fertility. It would seem logical that to reduce the impact of Striga infestation is to improve soil fertility. Indeed, the application of nitrogen in the form of urea or farmyard manure has been shown to reduce *Striga* incidence (Pierce *et al*., 2003). However, the use of urea by small-scale farmers is limited by its high cost and that of farmyard manure by its inviolability and poor quality.

Cropping systems including legumes as green manure are probably the most efficient ones since the nitrogen input to the soil is directly related to the amount of nitrogen fixed by the legume. Incorporation of leguminous green manure results in rapid production of nitrogen, which becomes available for subsequent crops.

"Marejea" is used a green manure in rotation with food or cash crops, and in intercropping production systems. It is known to be grown in rotation with rice, maize, tobacco, cotton and in sugarcane, pineapples (Hawii), coffee (Brazil), beans (Brazil) and in orchard crops. In Sudan it has been intercropped with sorghum on heavy, calcareous montmorillonite, non-saline, alkaline soils. Occasionally it is found planted under cocoa palms. In Tanzania, as a green manure before maize, 'Marejea' was sown broadcast in the early rains and turned over about 45 days later (Fuggles – Couchman, 1939). The eye could pick out each year the plots in which 'Marejea' had been turned under, plants were strong, deep green, had a healthier appearance. Each season green manure gave a significant increase in maize yield over the unmanured plots. Recent experiments have demonstrated that Crotalaria in rotation with maize showed a mean nitrogen effect corresponding to ca 80 kg N/ha when cut and removed and about 120 kg N/ha when ploughed in the first year. (Temu, 1986).

The main objective of this study was to investigate the effects of green manure on soil properties and if these effects have any impact on *Striga* incidence.

Materials and Methods

Location and treatments

On farm experiments were started during the wet season of 2001 at two villages (Kilasilo and Itope) in Kyela district. The rainfall is monomodal, with annual rainfall of 1000-2600 mm. The soil of both sites is a well or moderately well drained fluvisol that supports the rice-cocoa farming system.

Participating farmers of both villages grew unreplicated plots of rice and 'Marejea' at the beginning of the rainy season in 2001. Some farmers had also an additional plots of medium and long duration pigeon pea, ICEAP 00068 and Mali. Farmers were advised to plough under the 'Marejea' at flowering stage but because of various commitments this was done much later by many of them. As would be expected, the trials were conducted under various degrees of precision. The rice crop was not fertilized.

Data collection and analysis

Soil samples were taken from 17 representative farmers (9 from Kilasilo and 8 from Itope) in Kyela district. Three replicate soil samples from 0-10 cm depth of each plot per farmer were taken for soil analysis. All soil samples were analyzed for pH (1: 1 in soil: water solution), available phosphorus (Bray – 1), organic carbon (Walkley and Black), total nitrogen (Kjeldahl procedure), NH_4 AcO – exchangeable bases and KCl – exchangeable aluminium and hydrogen.

Results and discussion

Table 1 shows the general characteristics of the soils and the effects of green manuring.

General soil characteristics

The pH ranged from medium acid (pH 5.4) to very strongly acid (pH <5.0) with the latter category forming about 90% of the samples analyzed. As expected for soils with very low pH, the exchangeable acidity (exchangeable Al + H) was fairly high. A very strong negative correlation between pH and exchangeable H was observed. The exchangeable acidity was dominated by exchangeable H. The aluminium saturation as a measure of toxicity is calculated by dividing exchangeable Al by the sum of exchangeable bases and exchangeable Al. The results indicate Al saturation was low and was not likely to pose any limitation to rice production.

The content of soil organic carbon was moderate while that of total nitrogen and available phosphorus was in most cases low. All soils had low contents of Ca, Mg and Na but medium to high levels of exchangeable K.

Effects of green manuring

In most of the cases green manure plots had a lower pH, lower contents of organic carbon, total nitrogen and available phosphorus compared to unmanured plots. Green manuring, however, increased levels of exchangeable H and K in most of the farms while the effects on other exchangeable bases was variable.

Conclusions and implications

The general soil characteristics have shown that, apart from nitrogen, very low levels of available phosphorus could still limit productivity. For example legumes, even when suitably inoculated, will not grow well unless soil nutrients are available. The main nutrient required in Tanzania is phosphorus. Low pH will also limit productivity.

An improvement of the soil N status by green manuring was not achieved for most of the sites. In fact green manuring decreased N content. The time of planting and the time of turning in the green material were not consistent for all the farms. These two factors have great influence in the success of green manuring as a nitrogen source.

Green manure should be ploughed under when still in their active growth stage. If ploughed under too early, leaching of nitrogen is likely to occur as decomposition is facilitated and nitrates tend to be washed out. Besides the bulky organic matter will be greatly reduced by the time its effectiveness is most needed and C/N ratios will be low. Thus, benefits for succeeding crops will be limited. If a green manure crop is ploughed in too late in the season or in a too mature state, the decomposition process may not have proceeded enough before the planting of the succeeding crop. Also if the green manure has a low N content (high C/N ratio) may cause an N-deficiency which may result to a stagnation in growth of the crop and thus depressed yields.

Despite the negative effects of green manuring on soil properties, very low *Striga* counts were recorded in manured plots during the latter part of season. There is a need to study the mechanisms involved in controlling the *Striga*. It is also recommended to include the application of P in the form of Minjingu Phosphate Rock. It is very effective in acid soils and because of its high Ca content it will also ameliorate soil acidity.

References

Fuggles – Couchman, N.R. 1939. Green manurial and cultivation trials made at Morogoro, Eastern Province, Tanganyika Territory. The East African Agricultural Journal 5 (3): p208-210

Pierce, S., Mbwaga, A.M., Ley, G.J., Lamboll, R.I., Press, M.C., Scholes, J.D. and Watling, J., 2003. Chemical characteristics of soil and sorghum from *Striga*–infested regions in Tanzania, and the influence of fertilizer application. Working Paper.

Temu, A. E. M. 1986: Effect of *Crotalaria zanziberica* as a previous crop on grain yield of maize: The Uyole Agricultural Bulletin V. 1(1)

Table 1 : Effect of green manuring on soil properties Itope Village

Farmer	**Treatment**	Soil properties								
		PH		OC **%**	Total N **%**	**Available P mg/kg**	Exchangeable bases **(me/100g)**			
		$H_2$0	**KCl**				**Ca**	**Mg**	**K**	**Na**
Abdala	Control	5.4	3.4	1.91	0.18	3.31	2.13	0.7	0.88	0.6
	Marejea	4.75	3.4	1.76	0.16	2.42	0.73	0.8	0.98	0.04
Mwema	Control	4.7	3.4	1.77	0.16	2.16	1.77	0.71	1.14	0.05
	Mbaazi	4.63	3.4	1.51	0.14	1.36	1.77	0.73	0.75	0.06
	Marejea	4.5	3.4	1.78	0.16	1.30	1.73	0.57	0.75	0.05
Yusufu	Control	4.73	**3.5**	**1.78**	**0.17**	1.09	2.23	0.73	0.8	0.06
	Marejea	4.53	**3.47**	**2.25**	**0.21**	0.83	0.93	0.83	1.69	0.06
Asajenie	Control	**4.73**	**3.57**	**2.24**	**0.21**	4.08	5.57	0.8	1.21	0.07
	Marejea	**4.73**	**3.7**	**2.24**	**0.21**	2.83	1.63	0.77	1.43	0.07
Rehema	Control	4.77	3.53	2.13	0.2	8.36	1.17	0.7	0.88	0.09
	Marejea	4.9	3.77	2.06	0.20	4.08	2.23	1.17	1.03	0.08
Mng’anda	Control	4.83	3.7	2.18	0.21	10.7	1.32	3.8	0.8	1.00
	Mbaazi	4.77	3.67	2.05	0.19	1.48	3.03	0.9	1.36	0.06
	Marejea	4.67	3.63	2.15	0.21	0.90	3.83	0.9	0.82	0.09
Hamisi	Control	5	**3.6**	**1.77**	**0.16**	0.64	2.17	0.87	1.06	0.06
	Marejea	4.87	**3.6**	**1.83**	**0.17**	0.24	2.33	0.83	1.17	0.03
Lyson	Control	4.8	3.17	1.63	0.15	1.64	1.9	0.4	0.96	0.09
	Marejea	4.63	3.17	1.54	0.13	2.41	1.53	0.6	0.57	0.05
Kayuni	Control	4.87	3.17	1.71	0.16	1.50	1.8	0.83	0.83	0.07
	Marejea	4.8	3.2	1.59	0.14	0.94	1.97	1	0.47	0.04
M’tage	Control	5.3	3.87	2.31	0.21	5.51	5.8	1.13	1.79	0.07
	Marejea	4.67	3.3	1.81	0.16	3.19	1.1	0.7	0.89	0.04
M’ndela	Control	4.63	**3.23**	**1.85**	**0.17**	1.25	1.5	0.6	0.75	0.04
	Mbaazi	4.67	**3.3**	**2.23**	**0.2**	3.98	2.4	1.2	0.18	0.07
	Marejea	4.7	**3.23**	**1.97**	**0.19**	2.75	1.67	0.97	0.73	0.05
Isumo	Control	4.97	3.4	1.81	0.16	2.20	1.47	0.9	0.71	0.10
	Mbaazi	4.97	3.43	1.46	0.13	0.71	1.87	0.87	0.82	0.10
Mpopo	Control	4.7	3.43	1.94	0.18	1.12	1.57	0.03	0.59	0.03
	Mbaazi	**4.77**	**3.5**	**2.15**	**0.2**	**1.61**	**1.67**	0.93	0.72	0.05
	Marejea	4.73	3.33	1.7	0.15	1.48	1.5	0.8	0.8	0.03
M’seba	Control	5.1	**3.4**	**1.18**	**0.10**	**0.78**	**1.1**	0.77	0.29	0.12
	Marejea	4.53	**3.4**	**1.41**	**0.12**	**1.12**	**1.47**	0.7	0.31	0.07
Sunkey	Control	4.7	**3.47**	**1.56**	**0.13**	2.00	1.17	0.7	0.55	0.06
	Marejea	4.63	**3.53**	**2.1**	**0.16**	0.98	1	0.47	0.68	0.04
Mwalinga	Control	4.9	3.6	1.64	0.14	1.54	0.97	0.67	0.76	0.05
	Marejea	4.73	3.5	1.25	0.10	1.46	1.1	0.7	0.81	0.05
Mboge	Control	5.17	2.37	1.41	0.12	0.94	1.13	0.83	0.85	0.04
	Marejea	5.27	3.6	1.12	0.1	1.29	1.9	0.83	0.94	0.07

Appendix 5:.List of participants

5. 1 Kibangile village – Matombo-Morogoro rural district.

Name	Address
1.Dr A.M. Mbwaga	ARI-Ilonga
2.Dr G. Ley	ARI-Mlingano
3.Mrs E. Masangya	Morogoro District Agrc. Office
4.Mr C. Massawe	ARI-Ilonga
5Mr J. Kayeke	ARI-Uyole/SUA Mororgoro
6.Mr H. Kisumo	Matombo Extension Officer
7.Jumanne Rashid	
8.Rajabu Salum	
9.Kwanyu Hamis	
10.Josephine Amos	
11.Hadija Salum	
12.Peter Roman	
13.Mzeru Mbaruku	
14.Hadija Ramadhani	
15.Maria Matey	
16.Stefania John	
17.Yahya Selemani	
18.Salehe Ahmad	
19.Filbert Roman	
20.Ally S. Kidunda	
21.Pilly Mohamed	
22.Hadija Athuman	
23.Halima Ramadhani	
24.Anjelika Aloys	
25.Hatibu Yahya	
26.Abdu Ally	
27.Mchilo Fuku	

5.2 Kiswira village – Matombo-Morogoro rural district

Name	Address
1.Dr A.M. Mbwaga	ARI-Ilonga
2.Dr G. Ley	ARI-Mlingano
3. E. Masangya	Morogoro District Agrc. Office
4. C. Massawe	ARI-Ilonga
5. J. Kayeke	ARI-Uyole/SUA Mororgoro
6. H. Kisumo	Matombo Extension Officer
7.George Mkami	Group Chairman
8.Adolf Mawango	Member
9.Aloys Dominic	Member
10.Magdalena John	Member
11.Silili Henhry	Member
12. Mdachi Daudi	Member
13. Albertina thomas	
14. Wilvina Damas	
15 Michael Roman	
16.Moshi Rashid	
17. Antonia Antony	
18.Vincent Midongo	
19.Pius Mwagila	
20.Costantine Antony	
21.Isdory Malini	
22.Felister Rocky	
23.Dorothea Raphael	
24.Patric Fransis	
25.Helalius Mligumwe	
26.Otto Mzeru	

5. 3 Itope village – Kyela district:

Name	Address
1.Dr A.M. Mbwaga	ARI-Ilonga
2.Dr G. Ley	ARI-Mlingano
3. A. Mwambungu	Kyela District Agrc. Office
4. J. Kayeke	ARI-Uyole/SUA Mororgoro
5. M. Mwampaja	Kyela District Agrc. Office
6. H. Mwangosi	Kyela District Agrc. Office
7. Samson Mwakanyamale	Group Chairman
8. Edward Mwang'onda	Group Secretary
9. Yusuf Kayui	Member
10. Asajenye Mwakitubwa	Member
11.Michael Mwambehile	Member
12.Rehema Mwalaba	Member
13. Abdallah Mbalangwe	Member
14. Sarah Ipopo	Member
15.Jelton Msigani	Member
16.Mwema Hamisi	Member
17.Layson Kayuni	Member
18.Teresia Mwaisabila	Member
19.Victoria Kyamba	Member
20.Christopher Mwaisabila	Member
21.Maksa Kyando	Member
22.Andengenye Mwamtwango	Member
23.Hamis Mwema	Member

5.4 **Kilasilo village- Kyela district**

Name	Address
1.Dr A.M. Mbwaga	ARI-Ilonga
2.Dr G. Ley	ARI-Mlingano
3. J. Kayeke	ARI-Uyole/SUA Mororgoro
4. M. Mwampaja	Kyela District Agrc. Office
5. H. Mwangosi	Kyela District Agrc. Office
6. Asegelisye Mwaseba	Secretary
7.Oscar Mbonge	Village Govt Chairman
8.Erasto Mwaipopo	Member
9.Jail Mwakatage	Member
10.Alfred Mwamundela	Member
11.Flora Samwilo	Member
12.Tusajigwe Isumo	Member
13.Nancy Mgogo	Member
14.Sinyangile Nambisa	Member
15.Lingistone Kalinga	Member
16.Kabalika Mwandenuka	Member
17.Adam Mwasanguli	Member
18.Sankey Kandonga	Member
19.Albert Mwakanyasi	Member
20.Agrey Aliko Mwamundela	Member
21.Vumilia Bernard	Member
22.Ester Kubali	Member
23.Njoka	Member
24.Kerani Mwakasanga	Member
25.Elias Mwamgomba	Member
26.Mwangulu Mwakibole	Member
27.Luti Katundu	Member
28.Aman Mwamundela	Member

5.5 **Konjula village – Kyela District**

Name	**Address**
1.Dr A.M. Mbwaga	ARI-Ilonga
2.Dr G. Ley	ARI-Mlingano
3. J. Kayeke	ARI-Uyole/SUA Mororgoro
4. M. Mwampaja	Kyela District Agrc. Office
5. H. Mwangosi	Kyela District Agrc. Office
6. Mwakalinga	Kyela District Agrc. Office
7. Grace Ephraim	Member
8.Aliko Mwakipembe	Member
9.Jackson Salim	Member
10.Robert Mwailubi	Member
11Andwele Mwakasege	Member
12Twitike Jungwa	Member
13Bupe Kisya	Member

5.6. Sinyanga village

Name	Address
1.Dr A.M. Mbwaga	ARI-Ilonga
2.Dr G. Ley	ARI-Mlingano
3. J. Kayeke	ARI-Uyole/SUA Mororgoro
4. M. Mwampaja	Kyela District Agrc. Office
5. H. Mwangosi	Kyela District Agrc. Office
6.A.Mwakalinga	Kyela District Agrc. Office
7.White Mwansasu	Member
8.Shaaban Njetile	Member
9.Israel Mwaijande	Village Government Secretary
10.Simfukwe	Teacher, Nkokwa Primary School
11.Juma Mtawa	Memeber
12.Lusekelo Kawilo	Farmer Research group chairman
13.Mrs A. Syola	Memeber
14.J panja	Member
15.G. Mwakibambo	Member
16.J. Kunjelenje	Memeber
17.B Njetile	Member
18.Frank Panja	Memeber
19.A. Ndingania	Memeber
20. A. Mtawa	Member
21. Bupe Kipesile	Group Secretary
22.Emmanuel Kuyokwa	Member

Rural Development Strategies through Farmer Groups and Farmer Oriented Research: A case study[1]

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Abstract

Despite several past efforts to increase smallholder production with the objective of reducing both food and basic need poverty in rural Tanzania, majorities of the Tanzanian are still poor. This paper reviews the constraints and past strategies in agriculture/rural development sector. New approach, which is based on farmers oriented research groups, is presented as a case study from two sites in Tanzania. Evidence from the initial finding suggest that farmers oriented research have high possibility of success for imparting the required change towards rural development than the previous approaches.

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1 Introduction

After four years of independence Tanzania remains one of the 10 poorest counties in the World. Tanzania's per capital gross national product of US$ 265 is low and far less than sub-Saharan Africa and East Asia average of US$ 500 and US$970 respectively (World Bank, 2000). Poverty remains wide spread, deep and concentrated in rural areas, where approximately 70% of Tanzanians live. Agriculture which account for 45% of the national production and provide 80% of total employment and hence the sector will, for unforeseeable, remain the backbone of the economy. The World Bank concludes that only a prospering agricultural sector can provide the basis for sustainable poverty reduction and accelerated growth in other sectors.

Various qualitative and quantitative poverty assessments have been made in Tanzania over the last decade. They conclude those 27% of the population (based on 1992 figures) who lives below the food poverty line and 56% below basic need poverty line. The best-off 20% have expenditure levels nearly 10 times that of the poorest. It is estimated that

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the economy will need to grow by 7.5% for 23 years and by 9.7% for 15 years if poverty reduction targets are to be met. Growth throughout 1990s and early 200s was 3.5% per annum. Many studies on the slow intensification of agriculture in Tanzania identifies reasons that are common in many parts of Africa – that is constrained access to inputs, credit and timely advice based upon sound research (World Bank, 2000).

In Tanzania, for example, the implementation of various rural development strategies depended wholly on the Government. Period between 1961 and the late 1970s the Government was able to expand and strengthen basic social services such as health and education. During the period the country made rapid socio-economic development and registered high social development indicators in primary enrolments, literacy rates, health services, safe and clean water. Similar indicators were recorded in agriculture. However, by the mid 1980s these achievements could not be sustained. The heavy reliance on Government budgetary resources was untenable, and Government was unable to cope with the shocks that affected the economy.

Agriculture being the pillar of economic development, poor performance of the economy was quickly reflected by sharp decline in agriculture production in almost all crops which emanating from a multitude of factors. Later on some evidences revealed that, the problems of agricultural research and development in Tanzania have been related with poor transfer of knowledge from research to farmers. Among immediate remedies for implementing institutional changes involved the decentralization of management of extension services to local government and of research to a network on zonal programs. Furthermore, client oriented research and extension is now adopted as national policy as central to the Government of Tanzania Agricultural Development Strategy. This paper outlines key role played by the agricultural sector in poverty alleviation and the associated problems and finally a case study presenting the user friendly technology to promote smallholder rice productivity in two sites in Tanzania is discussed.

2 Needs for appropriate rural development strategies

Development of rural areas is a major concern of social and economic development policy in Tanzania. There are seven main reasons the formulation of rural development strategies. These include;

- Past government policies and strategies failed to build up the necessary capacity that was needed to bring about a sustainable development in rural areas.
- The formulation of rural development strategy relates to the fundamental structural reforms that have taken place during the last ten years or so. The broad objectives of these reforms had been to ensure macro-economic stability and improve market efficiency. Despite achievements indicated in inflation rate reduction, exchange rate stabilization, increased balance of payment, but it is increasingly perceived that these achievements have not benefited majority of the Tanzanians, particularly those living in rural area.
- Formulation of rural development strategy arises from unsatisfactory performance of the agricultural sector, the economic base of the rural areas. Performance of most food crops has remained poor, mainly due to extreme rainfall pattern and low technology used. As a result the food security situation has remained one of the major problem in rural areas.
- The absence of a comprehensive rural development strategies
- The need to emphasize economic diversification in the rural areas. This strategy originates from the fact that, even though agriculture in the backbone of the rural economy, diversification opportunities for earning income in the rural areas is crucial for rural development.
- There is a need to recognize the interrelationship between the rural economy and the urban market.

Most of these rural development policies have links or complement agricultural development strategies hence poverty alleviation.

3 Role of agricultural in rural sector and poverty adoption

In Tanzania, the importance of agriculture cannot be overstated. As indicated above, it accounts for about half of the national income, three quarters of merchandise exports, and is a source of livelihood for about 80% of Tanzanians. Agriculture has a strong link with the non-farm sector through agro-processing, urban market, and export trade. Trend in poverty reduction is highly dependent on the growth of agriculture and related non-agricultural activities.

The Draft Agricultural Sector Development Strategy has discussed extensively the performance of agricultural sector. From colonial period when production policy was on export crops, there have been several approaches, which intended to increase agricultural production among rural poor in the country. Policies and political strategies such as transformation approaches, *Ujamaa* mode of production, villagization, *Siasa ni Kilimo* (Politics is Agriculture) and *Kilimo cha Kufa na Kupona*,(Agriculture is a matter of life and death) were propagated in the country history. Parallel to these campaign or policies, different extension approaches such as training and visit, progressive farmers approach have been implemented to promote the desired change in smallholder production.

Since 1981 the real agricultural GDP grew at an average of only 3.5% per annum. However, between 1990 and 1993 the annual growth rate of the sector declined drastically from 6.7% to a mere 0.4% before raising to 6.6% by 1995. In 1996 the annual growth rate was down to 4.6% and declined further in 1998 to 2.3%. From 2000s, while the production of major food crops has grown by 3.5% and export crops by 5.4%, other components like livestock and forestry have recorded lower growth rates (TAS, 2000). Considering the overall GDP growth target of halving abject poverty by 2010 is in the range of 6-7%, and current population growth rate of 2.8% (Population census, 2002), this performance falls short of the needed growth.

As such, despite all previous efforts even the aggregate national food availability in Tanzania is still inadequate. Food production has failed to meet its production shortfalls. The constraints and obstacles that have hindered the development of the sector include;

a) Inadequate access to and/or delayed delivery of inputs and lack of timely advice;
b) Poor transfer of knowledge from researchers to farmers, inadequate access to extension services and over-centralization of the management of the extension services;

c) Decline in the use of improved farm input packages, particularly improved seed, fertilizer and agro-chemicals
d) Very poor infrastructures and lack of comprehensive market information
e) Inadequate credit for agricultural production and marketing
f) Weak management of co-operative and members loss of confidence
g) Unpredictable restrictions on crop movements and multiple taxes and levies
h) An unfavorable Land Act and slow implementation of the revised legislation
i) Dominance of low technology with the majority of the smallholder farmers
j) Dependence on rain, thus subjecting agriculture into the whims of nature.

To tackle these constraints and to strengthen efforts of reducing poverty, in recent years the government has undertaken several measure such as deregulation the markets and prices, and support private sector and NGOs to undertake production, input supply, and crop market functions. Also the government is mandated to support national and non-governmental establishments to research and extension to improve its effectiveness, and to promote private sector participation in production, processing, storage, input supply and marketing. It is within this matrix that the following section presents an overview of the strategies used by research establishment improves productivity of resource poor rice farmers by using cheap and locally available material in Kyela and Matombo sites in Tanzania. This strategy was institute to capture the existing situation in the research areas, prevailing macro-economic policies, and the need for sustainability of the technology.

4. Project for enhancing rice production using green manure

4.1 Introduction

Poor yields of *Striga* infested upland rice are associated with low and declining soil fertility. A context analysis undertaken with farmers in four villages close to Lake Nyasa, in Kyela district (Mbeya Region) has indicated that as infestations by *S. asiatica* have increased rice yields have declined from approximately 20 bags per acre 20 years ago to little more than 2 bags per acre today. A similar situation has been reported by farmer groups in two villages in the Uluguru Mountains of Morogoro Rural District

(Morogoro Region). Here, *Striga* is also a serious problem in maize, also an important food crop in the district. Although production can increase if artificial fertilizer is used, high prices following macro-economic reforms (due to removal of subsidies) and limited availability due to poor accessibility grossly affects its use among poor households who depend on rice for food and income. Table 1 shows a summary of main problems affecting rice farming in the study sites. Declining soil fertility and weed (including *Striga*) ranks highest in all study sites (Morogoro and Kyela).

Table 1. Main constraints in rice production

	(%) Response by study sites		Overall score	
Constraints in production	**Kyela**	**Morogoro (R)**	**Frequency**	**%**
Declined soil fertility	24.6	25.0	42	24.7
Striga infestation	22.8	23.2	39	22.9
Weed infestation	18.4	21.4	33	19.4
Rainfall variability	6.1	10.7	13	7.6
Diseases	7.9	5.4	12	7.1
Lack of farm implements	5.3	8.9	11	6.5
High prices for farm inputs	9.6	0.0	11	6.5
Poor cultural practices	4.4	0.0	5	2.9
Land problem	0.0	3.6	2	1.2
Market problems	0.9	0.0	1	0.6
Bird attack	1.6	0.0	1	0.6

SOURCE: Survey results, 2003.

An alternative strategy is to improve the fertility of *Striga* infested fields by growing legumes in rotation with susceptible cereals. From initial trials with the green manure Marejea (*Crotalaria ochroleuca*) the farmer research groups in Kyela observed that rice performs in a similar way when planted following a crop of the green manure *Crotalaria* as it does when treated with urea. This practice therefore offers farmers a low cost approach to soil fertility enhancement to improve rice productivity on *Striga* infested soils. Pigeon pea is also known to increase soil nitrogen levels and is a well-known crop in both Kyela and the Uluguru mountains. Locally available varieties are however late maturing and susceptible to the wilt disease *Fusarium udum*. Work by Ilonga Agricultural Research Institute has led to the selection of medium duration, disease resistant lines, which have been favorably evaluated by farmers. The key activity involves a series of on-farm demonstrations, managed by farmers following training and with support from district extension staff and the project team. On-farm trials undertaken by farmer groups collaborating with CPP funded project R7564 in Kyela demonstrated how rice yields can be increased by 25-50% by application of 25-50 kg Nitrogen ha^{-1}, while the infestation level of *Striga* is decreased. The majority of farmers are not however prepared to invest their limited cash in fertilizer. This report summarizes observations made prior to harvest of demonstrations planted in the 2002/03 crop season.

4.2 Methodology

The use of *Crotalaria* or pigeon pea (*Cajanus cajan*) in rotation with rice to combat *Striga* and low soil fertility had been introduced in Kilasilo and Itope villages in Kyela prior to the 2001/02 crop season when farmers were provided with seed for on-farm trials. During discussions with farmers it was subsequently agreed to incorporate these into the demonstration programme in each village. Plots previously planted to *Crotalaria* or pigeon pea in 2001/02 were planted with rice in 2002/03. Four villages, Sinyanga and Konjula, Itope and Kilasilo in Kyela and Kiswira and Kibangile in Morogoro Rural were identified for conducting this promotional project. High incidences of *Striga* weed and marked decline in rice production were main reason for choosing these sites. Initially seminars were conducted in each selected village just before the planting season i.e. in September to November 2002. The main objective was to introduce farmers to the potential benefits of the legume/rice rotations. Farmer groups were then formed within each village to undertake demonstrations at a number of sites. It was agreed that at each site there would be single plots, side by side, of *Crotalaria*, disease resistant pigeon pea and rice. All plots would be planted to rice in the following season.

The farmer group accompanied by a multi-disciplinary project team[3] in their respective villages visited all sites. At each site the host farmer described the demonstration, provided information on dates of field activities. Farmers were encouraged to discuss what they had observed so far during the season. Following the field visit findings were summarized and a group discussion held to confirm aims and objectives of the on-going program and future work. A multidisciplinary project team comprising following members conducted field

4.3 Observations

4.3.1 Kilasilo

This is one of the two villages in which on-farm trials with *Crotalaria* and pigeon pea had previously been undertaken. Seventeen farmers, including six women, participated in the plot monitoring and subsequent group discussion. The performance of rice planted following either *Crotalaria* or pigeon pea was observed at seven sites and new demonstration plots of the legumes have been planted at 10 sites. These will be planted with rice next season. Observations made at each site are presented in Annex 1. A summary of the situation in Kilasilo follows.

- Excellent collaboration between the group and extension staff; the group secretary has maintained good records of activities at all sites. Most group members are clear about the objectives of the demonstrations and can explain the potential roles of the legumes in the cropping system.
- Previous interaction with the project team and extension staff during the on-farm trial phase, frequent discussion and active group leadership has resulted in strong

[3] Dr A M Mbwaga - Plant Pathologist/*Striga* specialist, ARI Ilonga (Project Leader); Mr C Massawe – Agronomist, ARI Ilonga; Dr G Ley – Soil Scientist, ARI Mlingano; Dr J Hella – Agricultural Economist – Department of Agricultural Economics and Agribusiness; Mr P Lameck – Social scientist – INADES - Formation; Mr J Kayeke – Agronomist and post graduate student, Sokione University of Agriculture; Dr C Riches – weed scientist, Natural Resources Institute, UK; Mr Mwambungu – District Agricultural and Livestock Development Officer (Kyela district); Mrs Masanja - District Agricultural and Livestock Development Officer (Kyela district)

ownership of the demonstrations by group members in Kilasilo. The village chairman is playing an active role in the group, which appears to enhance cohesion.

- Considerable interest is reported from other farmers in the village who have seen the demo plots. This group appears ready to host field days at a few selected sites for other villagers.
- Demonstrations are generally well laid out, were planted on time and have been well managed. In some cases the "lie of the land" had not been considered when deciding plot location and this needs to be emphasized in future.
- Strengths of *Crotalaria* perceived by farmers: increased vigour, colour and tillering of the following rice crop; yields after the green manure are expected to be higher than in continuous rice. Less weed growth is seen in the subsequent rice crop - in a number of cases continuous rice was weeded twice while rice after *Crotalaria* was only weeded once. Weakness of *Crotalaria*: land is taken out of food/cash crop production for one season. However many farmers pointed out that on areas which are infested by *Striga* the rice yield is now so low that little yield is actually foregone.
- Strengths of pigeon pea: new varieties mature earlier than local types; following rice crop grows well. Weakness of pigeon pea: The crop does not suppress weeds.
- There is a shortage of land in Kilasilo and many households rent plots from other farmers. However, rental contracts are limited for two years. Farmers planting *Crotalaria* in the first year of the contract are potentially increasing the fertility of land they must subsequently return to the owner. Pigeon pea may therefore be a better bet on rented land with farmers planting *Crotalaria* on their own land.
- Farmers report an increasing demand for *Crotalaria* seed. Group members wish to increase the areas planted on their fields while other farmers are showing interest in planting the green manure also. A number of group members indicated that they would give some seed to others. All the plots planted in Kilasilo this season used seed harvested from on-farm trials the previous year. As plot size has increased considerably, as farmers gain more confidence, there should be more seed available for harvest this season. It will be interesting to see if seed sales begin.
- Analysis of soil samples taken from demo sites in Kilasilo, and indeed in other participating villages in Kyela, has shown the soils to be very acidic (pH 4.5 to 4.8)

deficient in nitrogen, and very low in phosphorous. While using legumes can increase nitrogen status, acidity and phosphorus will remain a problem.

- As farmers learn more about using *Crotalaria* and the new pigeon pea varieties they are experimenting with other plots beyond the demonstrations and are planting additional areas to multiply seed. This process needs to be documented carefully.

4.3.2 Itope village

Some of the farmers participating in the demonstration program in Itope were also members of the farmer research group and have been involved in on-farm trials with urea and *Crotalaria* since 1997. Nine farmers, including one woman, visited the field sites and attended the group discussion to monitor progress with the current demonstrations. The performance of rice planted following either *Crotalaria* or pigeon pea was observed at eight sites and new demonstration plots of the legumes have been planted at six farms. These will be planted with rice next season. Observations made at each site are presented in Annex 1.

- Despite continued interaction with the project team and extension staff, participation by farmers beyond an enthusiastic core of group members in field activities has been disappointing. This seems largely due to poor group leadership and management. The farmer who has been group leader for some time is not committed to the work unlike some of his younger colleagues. It is understood that following this visit by the project team the group held a meeting and persuaded the current chairman to step down to make way for a more enthusiastic leader. Participation by women is particularly poor despite previous assurances from members that they would encourage their wives and other women to become involved.
- A number of sites had been planted later than other crops on the farm and some participants had clearly given the demonstrations low periority. Record keeping has also been incomplete.
- Some of the demonstrations are on small pieces of land away from the main fields. In future all farmers should be encouraged to embed the demonstrations within their main fields and plant the plots at the same time as their main crops.

- Despite these problems a number of good demonstrations with large plots of *Crotalaria* and pigeon pea and follow up crops of rice have been established. As in Kilasilo the effect of the legumes in rotation is clear with the subsequent rice crop performing well. Farmers picked out the increased vigour of rice, and reductions in weed and *Striga* infestations in rice following *Crotalaria.*
- Most farmers in Itope own their own fields so *Crotalaria* would appear to be an ideal technology for the village.
- All *Crotalaria* plots have been planted with seed produced in the village in 2002. Farmers indicated an increasing demand for seed. Some participants wish to increase the area they are planting while a number of non-participants have requested seed for next season. One farmer has planted a particularly large area for seed multiplication and intends to sell seed at Tsh. 600 per kg.

4.3.3 Sinyanga

The farmer group was formed in Sinyanga following the village seminar in September 2002 held to introduce farmers to the potential advantages of using legume rice rotations on *Striga* infested land. Ten farmers, including one woman, attended the field visit and group meeting. Prior to the season the group had agreed a demonstration layout and seed was provided by the project to farmers. Of these who planted but due to erratic rain, drought and other problems only 2 sites have survived. A reasonable stand of *Crotalaria* although this had been late planted.

- Farmers in Sinyanga have access to a large are of lowland and their priority is to establish rice here by February. Upland rice is a secondary priority for many households.
- A number of farmers who had received seed indicated that they did not have enough knowledge about when and where to plant *Crotalaria*. They were also unclear about the potential benefits despite a number of visits by the extension worker. The men had not discussed the demonstrations with their wives.
- This is a new group, which so far appears to have little ownership of the programme. The plots are seen more as a research activity for the project team than an extension activity for the community.

4.3.4 Konjula

The farmer group in Konjula was also formed following a seminar in the village in December 2002. Unlike Sinyanga there is considerable enthusiasm among group members to undertake the demonstrations and learn about the use of *Crotalaria* and pigeon pea. Although there are extensive lowland fields here farmers are still interested in improving production in upland rice and maize. *S. asiatica* and *S. forbesii* are both problems. Demonstration plots are widely scattered and only 5 members of the group, including one woman, participated in the field visit and subsequent discussion. The project had provided 12 farmers with seed. Six farmers planted and five demonstrations have survived the drought. At one site the *Crotalaria* emerged but was mistaken as a weed and was removed by children sent to clean the field.

- The group is very interested in the demonstration programme and leadership appears strong. Some farmers did not plant because of the drought at the beginning of the season.
- Those who did plant established large plots of *Crotalaria*. Pigeon pea was not planted as fields are often at some distance from houses and farmers indicated that seed would be stolen.
- *Striga* was observed in a number of rice crops during the tour of the plots. Farmers indicated a number of areas, which had been abandoned because of low yields. They were impressed by the weed suppression achieved by *Crotalaria* and suggested that it will be easier to prepare land after *Crotalaria* than after a weedy fallow. Having seen the vigorous growth of the plants they are expecting improved rice yields next season.
- Farmers with demonstrations indicated that their neighbors have asked about the plots and have requested seed for next season. It was agreed that all plots of *Crotalaria* will be retained for seed production and that if possible seed will be given to other farmers for next season.

4.3.5 Kiswira village

This is the first season of work on *Striga* in the district. The farmer group was formed in Kiswira following the seminar held here by the project in September 2002. The Uluguru mountains have a bimodal rainfall pattern. Upland rice, maize and sorghum are planted on the short rains (October to early January). Because it is a long season crop it is important to plant rice early. The crop is also planted on wetland valley bottom sites. The long rains usually begin in mid-February following a few weeks of dry weather. Maize is the major crop on the long rains and rice is not planted. Rice is not therefore the dominant crop. Upland rice is often grown on steep, rocky slopes, which are farmed within a bush fallow rotation. The fallow period is about three years although this is said to be reducing due to population growth. A number of fields with very poor rice and maize crops were seen on steep, eroded fields in both Kiswira and Kibangile. Because rice and maize are both important and are infested by *S. asiatica* farmers were left to choose which crop to plant on demonstration plots

A total of 16 farmers participated in the field visits and group discussion. The group included nine women. Seed of pigeon pea and *Crotalaria* had been supplied to 18 farmers. Plots were planted at 11 sites but due largely to the drought only six have survived. The short rains failed almost completely with only isolated showers falling in late December and mid-January. The long rains have also been erratic. Farmers pointed out that this has been a most unusual year, and it has been difficult for them to decide when to plant. As a consequence the area planted to rice this season is less than usual and many crops are now drought stressed and will produce low yields. Farmers have planted maize in the long rains but these crops are also poor.

- The demonstration plots have been given low priority. This is partly due to the difficult climatic conditions. Farmers planted pigeon pea first and in general have very good stands. This is an established crop in the area and farmers are very interested to follow the performance of the variety supplied by the project. This matures earlier than local varieties. *Crotalaria* on the other hand was planted later and in most cases failed to establish despite replanting. This crop is not tolerant of drought in the seedling stage. Most farmers planted in January, prior to the dry spell ahead of the long rains. The late planting was associated with a lack of knowledge of how *Crotalaria* grows and how it can be used in the cropping system.

- Farmers in the area use a minimum tillage system for crop establishment. Crop residues and weeds are cleared and burnt prior to planting. Deep tillage is not undertaken. Crops are usually planted on the flat so opportunities for incorporation of *Crotalaria* or pigeon pea residues within the current system are limited. The alternative will be to retain a mulch of bio-mass rather than burning crop residue.
- It was agreed that the plots of *Crotalaria* that have survived would be used for seed multiplication. Some participants reported that other farmers are also asking for seed.
- When the demonstrations were planned group members discussed including plots of the cover crop legume "kraka" (*Pureria phaseoloides*). This was introduced as a ground cover for use in tree crops many years ago and has become naturalized in the area. Farmers did not plant any plots as they failed to collect seed. One lady farmer described how she grows maize on a field where kraka has become established. She slashes down the plants and sows maize into the mulch. During the crop season she slashes the re-growth between maize plants. This is said to result in good yields. While this may well be a good system for maize production, kraka is highly competitive and persistent and would be very competitive to young rice.

4.3.6 Kibangile

The cropping system here was similar to that in Kiswira. Sixteen farmers, including four women, participated in the field visit and group discussion. Of 14 who had received seed from the project nine planted plots. Of these five have survived the drought. Fields are widely scattered and there was only time to visit four sites.

- This was a well led group and a number of the members have tried hard to establish plots despite the weather. Most farmers gave highest priority to pigeon pea and there are some very good stands on the demonstrations. *Crotalaria* planted in late December or early January was affected by the dry spell preceding the long rains. This is clearly not a good time to plant. The best plot of *Crotalaria* was planted following the onset of the long rains and is now producing seed.

- Farmers estimated that 25% of fields are in bush fallow rotation. It may be difficult to establish *Crotalaria* on the gravel soils of the upper slopes, particularly when rainfall is erratic, as has been the case this season. However a possibility would be to plant the crop as the land is returned to fallow. It was also suggested that *Tephrosia* might be a better green manure crop for improving the fallow. *Crotalaria* is better suited to continuously cultivated fields.
- Most of the demonstration plots are a considerable distance from the main road and major paths. New sites selected for next season should be located along major paths, which lead to markets.

5 Conclusions and Future activities

5.1 Group performance

The ownership of the program by and commitment of the farmer groups to undertake the demonstrations varies considerably between villages. The difficult weather conditions have clearly not helped while in the "new" villages this season has been the first experience the groups have had with *Crotalaria* or with planting what they view as research plots. Good leadership and group management are essential and have been key in the success of the Kilasilo group. It was therefore agreed that the project team should provide more support to the groups in the form of training. It is proposed that this will be undertaken by INADES and will include training on leadership and discussion on the roles and responsibilities of group members. In addition it has been suggested that further groups may be formed for women or younger farmers in some villages e.g. Itope. INADES is to follow up the context analysis by collecting more information on the range of institutions found in each village. Formation of new groups will depend on the outcome of this work and further discussion with farmers. This work will take place after the current season has ended, probably in July.

Some of the groups involve village leaders and this is thought to have a positive influence on activities. Team members need to take more time to visit village leaders when then are undertaking fieldwork with the groups.

5.2 Farmer exchange visits and field days

Arrangements for a series of field days were discussed and agreed with extension staff. Farmers, village extension workers and district staff from Morogoro Rural will visit sites in Kilasilo and Itope in late May. The groups in Kiswira and Kibangile will each select five farmers to make the trip. This will provide an opportunity for them to see a number of sites where farmers are growing both *Crotalaria* and pigeon pea in rotation with rice. Also to learn from farmers in Kyela how they are managing the demonstrations and what they consider to be the advantages and disadvantages of each crop. Farmers from Morogoro Rural will be able to learn the methods used in Kyela for incorporating the bio-mass prior to the next rice crop and how *Crotalaria* seed is harvested and stored. They will then give this information to other members of their groups when they return home.

Similar exchange visits will be arranged for farmers from Sinyanga and Konjula. It is hoped that seeing the performance of rice after the legumes in the field at Kilasilo and Itope will give them more confidence to afford a higher priority to the demonstrations in their villages next year. Extension staff will also organize field days at selected demonstration sites in Kilasilo and Itope to promote the use of rice/legume rotations to farmers who are not members of the farmer groups. It will be important to monitor who attends and requests seed for subsequent follow-up.

5.3 Information sources

As the use of *Crotalaria* increases farmers have been learning how to manage the crop. The issues needing particular attention are:

- Where and when should it be planted? - *Crotalaria* appears most suitable for use on land which is owned rather than rented, unless the rental period is long enough to justify the investment of labour in improving soil fertility. Similarly, for the Uluguru mountains, the green manure may be useful on continuously cultivated fields. The seedlings are not tolerant of drought and planting needs to be at the start of the most reliable periods of rainfall.
- How should the bio-mass be managed? – Farmers in Kyela who have access to draught animals and ploughs can incorporate the whole plants. Others have used hoes

to bury the bio-mass in ridges. Farmers in Kilasilo have observed that rice growth is better after incorporating *Crotalaria* although rice also performs better after using the bio-mass as mulch than where the green manure has not been planted. Farmers in the Uluguru mountains do not undertake deep tillage and may need to rely on using the bio-mass as a mulch.

- How should the seed be harvested? Likely options are to pick pods as they ripen or to cut the top branches with pods. These can then be dried for threshing later. As much bio-mass as possible should be left at the field.

Clear information on these and other aspects of rice/legume rotations for the management of *Striga* infested land needs to be made available to farmers and extension. Leaflets or posters in support of the demonstration program will also be particularly useful for promotion work beyond the core farmer groups and for scaling up to new villages. A farmer leaflet has been drafted and now needs to be finalized prior to pre-testing with farmers. The final draft will be tested by INADES in collaboration with district extension officers. It was also agreed that it would be useful to prepare a training manual for extension officers. This will provide more detail on the technologies. Members agreed to prepare an initial draft, which will be circulated to other members of the project team.

The groups are recording data from each demonstration site with assistance from village extension officers on a standard pro-forma. This includes dates of all operations, how these were undertaken (e.g. incorporation of *Crotalaria*) and *Striga* counts. Yield estimates will be made for all pigeon pea, rice and maize plots. This will include the cereal yield at sites where *Crotalaria* is being grown for the first time in order to assess the grain production foregone by planting the green manure.

List of reference

Population Census (2002) Preliminary report, Tanzania bureau of statistics, Dar es Salaam

TAS (2000)

World Bank, 2000