ON-FARM VERIFICATION AND PROMOTION OF GREEN MANURE FOR ENHANCING UPLAND RICE PRODUCTIVITY ON STRIGA INFESTED FIELDS IN TANZANIA

PROCEEDINGS OF THE STAKEHOLDERS WORKSHOP HELD AT TAFIRI HALL – KYELA, 20TH - 21ST JUNE 2005

Editors: A. Mbwaga, C. Riches J. Hella, J. Kayeke,

Ilonga, September 2005

<u>Cover page</u>: - Mbako Primary school children performing a local dance asa learning tool to disseminate knowledge on the use of Marejea to enhance soil fertility and control of Striga in rice, Kyela 2005.

- Fore front, Marejea crop

Workshop participants, Kyela 2005

From left front Row: Roman (Farmer-Matombo), Kamwela (DALDO Ileje), A. Mbwaga (Project Coordinator), F. Myaka (ZRC-E/Zone), J. Kamasho (ZRC-SH), DC-Kyela, DED-Kyela, Abraham (DALDO-Kyela)

Back row: L. Nsemwa, J. Hella (SUA), Mrs Mbena, Mangwale (DEO-Kyela), Ruheza (CARE- Morogoro), Mwipasi, G. Ley, Mrs Ishuza (DALDO Morogoro), Mwegole (DEO-Morogoro)

Summary

The practice of continuous cultivation of the limited available land done by resource poor farmers has resulted into declining soil fertility and hence declining yields of cereals. This is so because continuous cultivation is done without replenishing plant nutrients taken by growing crops. Poor soil fertility on the other hand favors infestation of witch weed - *Striga spp*, leading to further decline in yields of cereals in the infested fields. In 1996 Project (CPP R7564) funded by DFID started working with farmers to solve the problem of poor soil fertility and control of *Striga* in upland rice of Kyela district by using inorganic fertilizer Urea. Results showed to have soil fertility enhancement, rice yield to have increased per unit area and *Striga* infestation was significantly reduced. Unavailability and high prices of inorganic fertilizers made farmers to think for an alternative measure that can be affordable to them. That's when the idea of using green manure *Crotalaria* (Marejea in Kiswahili) was initiated. Project (R8194) funded by DFID was then launched in 2002 to evaluate the use of Marejea to improve soil fertility and control Striga.

The objectives of this workshop were then to look into the rational of the project, present results achieved through the project cycle and to develop the way forward. This was followed by technology promotion phase which will end in January 2006. The project worked on the use of Marejea to improve soil fertility and control *Striga*. The technology is very effective and easily practiced by the resource poor farmers. The project started in 2 villages in Kyela District but to-date the project has covered 8 villages in Kyela and 5 villages in Matombo-Morogoro rural, reaching about 189 farmers with more than 180 demonstration/ evaluated plots.

Primary schools were involved in the process of dissemination of information under Technology promotion project. A total of 15 schools in Kyela and 6 in Morogoro rural districts were involved. This project was executed in collaboration with a number of institutions. These include ARI Ilonga, ARI Uyole, ARI Mlingano, SUA, INADES, DALDO(District Agricultural and Livestoct Development Officer) Kyela, DALDO Morogoro, DEO (District Education Officer) Kyela and DEO Morogoro. For the past 3 years a number of activities both research and extension based have been implemented. This report presents the research results for the activities undertaken by the project for the project period as presented during the stakeholders workshop held at TAFRI Hall, Kyela in Mbeya region. The program of the workshop is as shown in Appendix 1

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OPENING SPEECH BY KYELA DISTRICT COMMISSIONER

Honorable E. Kalalu
Assistant Director Crops
Donor representative,
Research Extension Liaison Officers Eastern and Southern Highlands zones,
Research Coordinators, Eastern and Southern Highlands zones
Researchers in the project
Communication Officers,
DALDOs Morogoro and Kyela,
Representatives of various Institutes
Care-Morogoro, UMADEP, PADEP Morogoro rural, ADP-Mbozi and IRDTF-Ileje,
District Education Officers,
Agriculture officers Kyela and Morogoro rural
Ward Education Coordinators
Farmers,
Ladies and gentlemen.

May I take this opportunity to welcome you in Kyela District. At this time the weather of Kylela is good because it is warm. I thank you for choosing Kyela to this workshop, also I thank you for appointing me to open this workshop.

Dear participants, a lot of changes in agricultural research have taken place in our country. Previously the research was done on station and the results taken to farmers, but now the research is demand driven and is conducted on-farm where farmers have an opportunity to participate.

I m told that researchers, extension officers and farmers collaborate in the research are to come up with a suitable technology in farmers environment. This enables extension officers and farmers to participate and select the best technology to use in their fields. Therefore may I thank the researchers for selecting Kyela to conduct the research of improving soil fertility and control witch weed by using marejea. This research was done in the Kilasilo, Sinyanga, Itope. Ushirika, Ngana, Konjula, Kasumulu and Ipande villages where more than 105 farmers participated.

The research started on 1997 where organic fertilizers were used, in 2002 marejea came into use. From 2003 to 2005 season farmers prepared 93 demonstration plots. Result shows that marejea improved rice yield between 75-149% compared to the control plots. In the marejea treated plots witch weed was reduced by 63%. Congratulations for this achievement.
Results of the research are good in one side, the other side the speed of farmers to catch up and practice the technology which they participated to develop is very low. Still a big number of farmers are not taking a challenge to improve production by practicing the technology developed. In Kilasilo and Itope there only 22 and 10 farmers respectively who practice the technology, therefore we need other partners like Rural development Department to take charge.

I am giving you a challenge you to find out what constraints prevent farmers to use technologies participatory developed by researchers, extension agents and farmers. Later we want the reflection of the acceptance of the technology to be showed by the improved production in the fields.

Dear participants the project has come to an end, but the end of the project shouldn't be the end of the promotion of the technology. Together with other District leaders I visited the demonstration plots of a similar type of a project conducted by research, extension and farmers at Kikusya. Farmers were conversant with what they were doing but outside the demonstration plots there were poor plots and furthermore the participating farmers did not practice the technology in their own plots away from the project area. I therefore argue you not to get discouraged to carry other research and if possible repeat some research after improvement to put them in a way that farmers can adopt and practice. I also call upon research farmers to continue using this technology and advice other more farmers to practice it while we as the government together with extension agents we will ensure the technology remain sustainable.

After this note I declare the workshop officially opened.

Thank you for listening.

Papers presented:

A total of eleven papers were presented and discussed.

Problem of *Striga* on rice/maize production in Tanzania and control options.

A. Mbwaga and C. Massawe

Ilonga Agricultural Research Institute.

Introduction

Striga spp. (witchweed) are obligate parasitic plants that attach to the roots of specific host plants to obtain water, nutrients and carbohydrates. They are found from sea-level up to 1800 m altitude, in production systems with rainfall from 500 up to 2000 mm and in almost all soil types.

Economically important Striga species found in Tanzania include *S. hermonthica* (Del.) Benth and *S. asiatica* (L.) Kunze. *S. asiatica* is the most wide spread species while *S. forbesii*, has shown a limited distribution. It has been observed in Kyela, Morogoro, Coast and Dar es Salaam. These species infest cereal crops namely Maize, upland rice, sorghum, finger millet and to a small extent sugar cane. The other related parasitic weed is *Ramphicarpa fistulosa*, which infests flooded rice and is a major problem on the flood plain in Kyela district. It can cause up to 100% yield loss.

S. asiatica is widespread on sorghum and maize in semi-arid areas of Tanzania, but is also of importance on maize and upland rice crops in sub-humid lowland and highland districts of the country including Kyela and Matambo.

Striga is considered an indicator of low soil fertility; consequently it is most problematic on infertile or nutrient-depleted soils with low organic matter content. The weed is less damaging in high in-put systems when there is regular application of manure or fertilizer, In the low- input agriculture, on resource poor farmers fields, yield reductions ranging from 40% to a total loss of the crop are common.

Striga, especially in cereal-based cropping systems is not a new problem to farmers. The elders were aware of the occurrence of *Striga* as early as 1930s as a serious problem around the Lake Victoria region (Watt 1936).

Effect on yield:

- ►Yield loss: 40 – 90%
- ► On Severe infested farmers field yield loss can be up to 100%

Reasons for the increase of Striga problem

- Continuous mono-cropping of susceptible cereal cultivars with no rotation,
- Decline in soil fertility
- Use of machinery during land preparation
- Seed contamination with *Striga* seed during harvesting and processing
-

Possible Control Options

- Uprooting and burning/burying
- Use of animal manure
- Use of tolerant/resistant varieties
- Use of legume green manures (e.g. Marejea, Canavalia or Mucuna) in rotation/relay crop
- Other control options include inorganic fertilizer-Urea, herbicide – like 2-4D
- Integration of more than one technology e.g. Green manure plus resistant variety plus uprooting

Fighting Striga is life long journey (Kupambana na Kiduha ni Safari Ndefu (Umri wa mtu) an age of somebody.

Discussion

Q: Is there any possibility of a field to be attacked by *Striga* and *Ramphicarpa spp* at the same time.
A: No; because *Striga* is found on upland while *Ramphicarpa spp* is found on flooded plains, where Striga cannot survive.

Q: Why did *Striga* attack crops in an area that was under fallow for more than ten years?
A: *Striga* seed can stay viable in the soil for up to 20 years
Q: What control measures have been achieved against *Ramphicarpa spp* in the flooded field.
A: We have not done thorough research but herbicides like 2,4-D in combination with Ronstar has shown good control against the weed.

Q: Among *Striga* control measures which is effective in Kyela and which in Morogoro.
A: The uses of pigeon pea and Marejea have shown to be effective in both Kyela and Morogoro.

Q: Are there crops which show resistance to *Striga.*
A: Yes, in sorghum we have released variety Wahi and Hakika with resistance to *Striga*, in rice a landrace “Mwangulu” has a high tolerance to Striga and in maize we are still working on it.

Achievement in the use of green manure technology to increase soil fertility and control Striga for resource poor farmers.

J. Kayeke[1] and G.Ley[2]

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Abstract

Depletion of soil fertility is a major constraint in crop production facing resource poor farmers. In cereal production poor soil fertility creates a favorable environment for witch-weed (Striga spp) infestation. Inorganic fertilizers can be used to solve this problem but poor supply and high prices linit adoption by resource poor farmers. Therefore the use of green manure was chosen by farmers as the plausible alternative. Two experiments were conducted in Kyela and Morogoro with an objective of improving soil fertility and control of Striga infestation in rice and maize respectively. One experiment was conducted on-station and another on-farm, managed by farmers. Crotalaria ochroleuca (Sun hemp known as Marejea in Kiswahili) Mimosa invisa (Colla), Cassaia obtusifolia (Sickle pod) were used on-station while Marejea and Cajanus cajan (Pigeon pea) were used on-farm. Results show an increase in soil fertility, and improved rice and maize yield by more than 100% respectively following use of gren manure. Also there was a significant reduction of Striga infestation by more than 60% in the field.. In addition there was a reduction in weed infestation of cereals grown in rotation with green manures and increased household income.

Introduction

Depletion of soil fertility has been identified as a major problem hindering production of cereals in Tanzania. Apart from lowering the yields of cereals, poor soil fertility favors the infestation by parasitic weed (*Striga spp*) belonging to the family of Schrophuraliaceae*. Striga* is an important biological constraint that reduces yield of cereals from 10% to total loss (100%), depending on the level of infestation (Parker and Riches, 1993; Mbwaga *et al*., 2000). The recommendation for *Striga* management is the application of nitrogen fertilizers and herbicides such as imazethapyr I (Kanampiu *et. al,* 1997). Nitrogen fertilizer improves soil nitrogen which in turn reduces *Striga* infestation and improves yields of cereals (Parker and Riches, 1993; Kayeke, 1999; Mbwaga *et al*., 2000). Resource poor farmers who have limited resources cannot afford these technologies due to unavailability and high prices of inorganic fertilizers and herbicides therefore the use of green manure to improve soil fertility can be a good alternative. Green manures, normally legumes, are grown and incorporated in the soil to improve soil fertility status (Muller-Samann and Koschi, 1994). In the soil, green manures have to decompose to release nutrients for plant uptake. The nutrient released, improves fertility of the soil, improves yields of cereals, reduce *Striga* infestation by creating unfavorable conditions for *Striga* germination. Some green manure species reduce *Striga* seed population in the soil as they act as false hosts and cause *Striga* germination. In the control of *Striga*, green manures have proved to be effective and an appropriaate choice of small holder farmers due to low costs as observed by Kroschel and Sauerborn (1996). In their research work they found that 90% of interviewed *Striga* affected farmers in Tanzania, Malawi and Ghana wanted *Striga* control measures which are low-cost . Another advantage of green manure is the reduction of weed infestation in subsequent cereal crops.

A variety of plants which can be used as green manure include *Cajanus cajan* (Pigeonpea), *Crotalaria ochroleuca* (Sunhemp), *Carnavallia spp*, *Mucuna spp*, *Mimosa invisa* (Colla) and *Cassia obtusifolia* (Sickle pod)*.*

This paper presents research results on the use of green manure to improve soil fertility and control of *Striga* in rice and maize farming systems in Tanzania.

Materials and Methods

Two experiments were conducted to determine the influence of green manure in the control of *S. asiatica* and improvement of maize and upland rice yield. The first, a research-managed trial, was conducted on land rented from farmers and assessed *C. ochroleuca*, *C. obtusifolia* and *M. invisa* as green manures in rice. Another experiment was conducted on-farm (Farmer managed), where *Crotalaria ochroleuca* and *Cajanus cajan* was used as green manure on both rice and maize fields.

Experiment 1

Description of the experimental site

Location

The experiment was conducted in Kyela district in southern Tanzania.. The district lies on the floor of the West arm of African rift valley at the tip of Lake Malawi, at an altitude of 400 to 500 m a.s.l. Two experimental sites at Kilasilo and Itope villages were chosen. Previously, Kilasilo was under continuous cultivation for 5 years while Itope was under fallow for 3 years. Kyela receives 1000 mm to 2600 mm of rainfall per year, is under a monomodal rainfall system with the growing season lasting from November to June. During this study period, the following climatic data were collected: rainfall, soil temperature at 10 cm and 20 cm depth, minimum and maximum air temperature (Appendix 1).

Vegetation

Prior to the setting of the experiment, weeds in the experimental site were identified with the help of a field guide (Johnson, 1997). Types of weeds common at the site are as presented in Table 1.

Table 1: Weeds found in the experimental site – Kilasilo.

Family	Scientific name	Common name
Commelinaceae	*Commelina benghalensis* L.	Wandering jew
Cyperaceae	*Cyperus sphacelatus* Rottb.	Nut sedge
	Fimbristylis ferruginea (L.)Vahl	Globe fingerush
Poaceae	*Digitaria horizontalis* Willd	Couch grass
	*Sacciolepsis africana*C.E.Hubb& Snowden	Sacciolepsis
Rubiaceae	*Oldenlandia herbaceae* (L) Roxb	Oldenlandia
	Spermacoce ocymoides Burm.F.	Borreria
Tiliaceae	*Corchorus olitorius* L.	Jute mallow
Euphorbiaceae	*Croton hirtus* L.	Tropical croton
Pedaliaceae	*Ceratotheca sesamoides* Endl.	False sesame

Similarly at Itope, prior to the setting of the experiment, the weeds in the experiment site were as presented in Table 2.

Table 2: Weeds found in the experimental site – Itope.

Family	Scientific name	Common name
Tilliacea	*Triumphetta rhomboidea* Jacq	Paroquet bur
Rubiaceae	*Spermacoce acymoides* Burm.F.	Borreria
	Odenlandia herbacea (L) Roxb	Oldenlandia
Papilionoideae	*Calopogonium mucunoides* Desv	Calopo
Poaceae	*Rhynchelytrum repens* Willd.	Redtop
	Eleusine indica (L.) Gaetrtner	Goose-grass
	Cynodon dactylon L.	Bermuda grass
	Chloris pycnothrix Trin	False star grass
Cyperaceae	*Pycreus macrostachyos* (Lam) *Rynchospora*	Field sedge
	corymbosa(L.) Britton	Golden beak sedge
Pedaliaceae	*Ceratotheca sesamoides* Endl.	False sesame
Mimosoideae	*Mimosa invisa* L.	Colla
Asteraceae	*Vernonia glabra* (Steetz)Vatke	Vernonia(Bitter leaf)
	Ageratum conyzoides L.	Billy goat weed

Among the weed species, broadleaf weeds were dominant in terms of coverage.

Rice varieties

Supa India rice variety was used in this experiment because, it is planted by about 95% of farmers in the upland ecosystem and it is highly susceptible to *Striga* attack. Rice seeds for the experiment were bought from one farmer in Kyela.

Green manures used in this experiment were *C. ochroleuca* (sunhemp) (Plate 2)*, M. invisa* (Colla) (Plate 3) and *C. obtusifolia* (Sickle pod) (Plate 4)*.* The latter two are locally available and are regarded as weeds in upland rice (Johnson, 1997).

Soils

The landform of Kyela is described as flat lacustrine plain with alluvial fans, while the soils are described as Alluvial fine sands and clay loams (Mussei *et al.,* 1999). Upland rice soils of Kyela are dominated by Chromic Gleysols. These are imperfectly drained greyish sand loam to clay with moderate fertility (National Soil Services, 1993).

Before setting the experiments, composite soil samples were collected from each site and analysed for their physical and chemical characteristics. Eight soil samples were collected randomly from each site at a depth of 0 to 20 cm. Samples were then mixed to make a composite sample for each site, weighing 4 kg.

Soil samples were analyzed for the following Soil pH was measured by using a ratio of (1:2.5) soil: water using the method described by McLean (1982). Nitrogen was determined by micro-Kjedahl digestion method (Bremner and Mulvaney, 1982) while organic carbon was determined by wet digestion method of Walkley and Black according to Nelson and Sommers (1982). Available P was extracted by Bray and Kurtz-1 method and determined spectrophotometrically according to the procedure described by Murphy and Relay (1962). Cation Exchange Capacity was determined by neutral ammonium acetate saturation method (National Soil Service, 1987). The amount of exchangeable bases in the NH_4Oac extract was determined using atomic absorption spectrophotometer (Thomas, 1982). Soil particle analysis was carried out by the hydrometer method (Gee and Bauder, 1986). Micronutrients were extracted by Diethylene triamine pentaacetic acid (DTPA) and determined by atomic absorption spectrophotometer according to the method described by Lindsay and Norvell (1978).

Experiment layout and management

Three green manure plant species were used: *C. ochroleuca*, *C. obtusifolia, M. invisa*. Green manure species were planted in their respective plots of 6 m x 5 m at seeding rate of 25 kg ha^{-1}. After 2 months, at flowering , the green manure plants were ploughed under in their . Two days after ploughing Supa India rice variety was sown in each plot at 0.2 m x 0.2 m spacing.. These three green manures were tested in Randomized Complete Block Design replicated three times.

A separate experiment was also laid nearby where three green manure plots of *C. ochroleuca*, *C. obtusifolia* and *M. invisa* were left to reach flowering stage, rice was planted in the following season (2001/02). Green manure were sown in separate plots of 6 m x 5 m using a seeding rate of 25 kg ha^{-1} and were left to reach flowering before either ploughing under or cut as mulch. After reaching flowering stage, the green manure plants were ploughed under and cut as mulch in their respective plots and left until the following season. The following season (2001/02). Supa India rice variety was sown in each plot at 0.2 m x 0.2 m spacing. Treatment combinations are shown in Table 4.

Table 4: Experimental treatments***.***

Treatments	Green manure application method
1.*Crotolaria ochroleuca*	Mulch
2. *Crotolaria ochroleuca*	Plough under
3.*Mimosa invisa*	Mulch
4. *Mimosa invisa*	Plough under
5. *Cassia obtusifolia*	Mulch
6. *Cassia obtusifolia*	Plough under
7. Control	-

Randomized Complete Block Design with three replications was used to test the treatments. The same experimental plots were used for planting rice in the 2002/03 season without planting green manure. This was meant to assess the residual effect of green manure and green manure application methods, on the yield of rice.

Sampling area

Each plot measured 6 m x 5 m and comprised of 30 rows of rice plants.. An area of 4.8 x 5.8m was used for data collection on each plot.

Data collection and analysis

The number of tillers, panicles and height of 5 plants per plot were determined at physiological maturity. Grain yield was determined by harvesting all plants in the inner plot. Grains were threshed and winnowed to remove trash and unfilled grains. Fully filled grains were weighed. The weight was adjusted to 14 % moisture content according to Gomez (1972).

Weed counts (weeds other than *Striga*)

The number of weeds was determined by counting the number of broadleaf weeds and grass weeds separately. Counting was done by using a 0.25 m^2 quadrant where the average of 4 quadrants was recorded.

***Striga* count**

The number of *Striga* plants in the 6^{th} and 9^{th} weeks after rice germination were counted and recorded. The method used was to count all *Striga* plants per hill in the plot of 10 m^2. The large area was used instead of net area to avoid uneven distribution of *Striga* in a plot

Data analysis

The collected data was subjected to analysis of variance using (SAS/STAT, 1988). Data for weed counts were transformed before analysis. Because there were plots with zero *Striga* counts data was transformed using the square root of (x + 0.5 where x is the number of *Striga counts*). For other weeds transformation was by square root (Gomez and Gomez, 1984). After analysis treatment means were separated by Duncan Multiple Range Test/Tukey's Test and judged with significance at $P \leq 0.05$. In the presentation of the results, the original means were used.

Results

Physical and chemical properties of the soils

The results showing the physical and chemical properties of the soils are indicated in Tables 4 and 5.

Table 4: Some physical properties of experimental soils.

Site	% Sand		Clay (%)	Silt (%)	Textural class
	Coarse	Fine			
Kilasilo	38	5	40	17	Sandy clay
Itope	40	5	35	20	Sandy clay

Table 5: Some chemical properties of experimental soils.

Parameter	Site	
	Kilasilo	Itope
pH (H_2O)	5.21	4.56
OC (%)	1.80	2.45
Total N (%)	0.16	0.21
Available P $mgkg^{-1}$	5.20	9.10
CEC Cmol(+) kg^{-1}	16.90	21.80
BS (%)	26	25
Exchangable bases Cmol(+)		
Ca	1.3	2.2
Mg	0.54	0.78
K	1.7	1.6
Na	0.79	0.89
Ca:Mg	2.41	2.82
Al	Trace	Trace
Zn $mgkg^{-1}$	1.26	1.17
Cu $mgkg^{-1}$	0.13	0.17
Mn $mgkg^{-1}$	162.47	80.04
Fe $mgkg^{-1}$	29.56	27.72

The effect of green manure on weed (other than *Striga*) intensity

The results on the effect of green manure on weed other than *Striga* are presented in Table 6. At both sites Kilasilo and Itope grass and broadleaf weed counts, total weed count and total weed dry weight were significantly reduced where green manure was applied. *Mimosa invisa* and *C. obtusifolia* had significantly more grasses at Kilasilo and Itope respectively (18, 18.1 and 21.1, 18.6) than *C. ochroleuca* (12.5, 12.9). *Crotalaria ochroleuca* (24.8, 24.2) and *M. invsa* (19.9, 33.4) had significantly fewer weed total count compared to *C. obtusifolia* (33.4, 39.9) at Kilasilo and Itope respectively. The potential of green manure to suppress weeds was in the order of *C. ochroleuca* >*M. invisa* > *C. obtusifolia.*

Table 6: The effect of green manure on Weed density.

Weeds in m^{-2}								
	Kilasilo				Itope			
Treatments	Grasses	Broadleaf	Total count	Total dry wt (gm)	Grasses	Broadleaf	Total count	Total dry wt (gm)
Control	43.3a	37.0a	81.1a	120.0a	18.3a	33.8a	52.9a	126.3a
C. ochroleuca	12.5b	12.2b	24.8b	24.0d	12.9b	9.5d	24.2d	29.8d
M. invisa	18.0c	11.6b	19.9b	46.5c	18.1c	15.3c	33.4c	51.8c
C. obtusifolia	21.1c	12.3b	33.4c	56.9b	18.6c	21.0b	39.9b	66.6b
SE	0.36	0.39	0.31	0.27	0.30	0.21	0.16	0.21
CV (%)	13.20	16.64	8.26	6.35	12.78	8.47	4.68	6.62

Means in the same column for each site followed by a common letter are not significantly different from each other according to Duncan Multiple Range Test ($P \leq 0.05$)

The effect of green manure on *Striga* growth and development

The results show that all green manure significantly reduced *Striga* ($P \leq 0.05$) in both sites. The control plots had significantly more numbers of *Striga* than green manure plots in the 6th and 12th week after rice germination. The green manure plots had no *Striga* at all. The green manure species suppressed *Striga* equally effectively in both sites.

The effect of green manure on growth and yield of rice

The results on growth and yield of rice are presented in Table 7. The height of rice plants, number of tillers, panicle per plant and grain yield increased significantly with application of green manure in both sites. The yield varied significantly with the type of green manure. In Kilasilo, rice plots applied with *C. ochroleuca* had fewer plant tillers 9.1 than other green manure, but it had significant higher number of panicle per plant than other green manure. In both sites, rice plots applied with *C. ochroleuca* had significantly higher yield than other green manure. In Kilasilo, rice plots applied with *C. ochroleuca* (2846 kg ha^{-1}), rice plots applied with *M. invisa* (2626kg ha^{-1}) and rice plots applied with *C. obtusifolia* (2010 kg ha^{-1}). While the yield in Itope site was rice plots applied with *C. ochroleuca* (2818 kg ha^{-1}) > rice plots applied with *M. invisa* (2252 kg ha^{-1}) > rice plots applied with *C. obtusifolia* (1960 kg ha^{-1}).

Table 7: The effect of green manure on growth and yield of rice.

	Kilasilo					Itope				
Type	Plant height (cm)	Tillers/ plant	Panicles/ Plant	Panicle length	Yield $kgha^{-1}$	Plant height (cm)	Tillers/ Plant	Pani./ plant	Panicle length	Yield $kgha^{-1}$
1	85.0b	8.5c	8.4b	18.7b	1335d	90.0c	8.1b	7.1b	18.4c	1238d
2	91.1a	9.1a	8.8a	19.3a	2846a	98.7a	9.1a	8.7a	19.8a	2818a
3	89.9a	9.8b	8.8a	18.9b	2626b	97.6ab	8.7a	8.3a	19.1b	2252b
4	92.0a	9.7b	8.8a	19.4a	2010c	96.0b	8.8a	8.2a	19.4a	1960c
SE	1.42	0.15	0.11	0.22	53	1.33	0.23	0.22	0.26	42
CV (%)	4.76	5.06	4.06	3.47	7.20	4.19	8.15	8.50	4.07	6.14

Means in the same column for each site followed by a common letter are not significantly different from each other according to Duncan Multiple Range Test (P≤0.05)
Key 1= Control, 2 = *C. ochroleuca*, 3 = *M. invisa*, 4 = *C. obtusifolia*

The effect of green manure application methods on growth and yield of rice

Results in Table 8 show that application methods of green manure significantly (P≤0.05) increased rice grain yield and yield components in both sites. The control plots in both sites had shorter plants, fewer tillers per plant, shorter panicles and lower grain yield than green manure plots. In Kilasilo *C. ochroleuca* mulch and *M. invisa* plough-under promoted significant (P≤0.05) taller plants (100.7 cm and 102.6 cm) than the control (89.5 cm). In Kilasilo *C. ochroleuca* mulch promoted significantly taller plants, more panicles per plant, longer panicles and higher grain yield than other treatments. In Kilasilo plant height, vary significantly with application methods of green manure. Application methods of *M. invisa* did not significantly (P≤0.05) influence the number of tillers, panicle length, and yield. On the other hand, *C. obtusifolia* did not have an influence on panicle length and yield. High yield was recorded under *C. ochroleuca* mulch (3403 kg ha^{-1}) followed by plough under (3214 kg ha^{-1}), control which had significantly (P≤0.05) low yield.

Crotalaria ochroleuca and *M. invisa* showed a significant (P≤0.05) difference in plant height between mulch and plough under. The plant heights for *C. ochroleuca* were 102.7 cm and 107.2 cm while those of *M. invisa* were 103.1 cm and 107.7 cm. The number of tillers varied significantly (P≤0.05) under *M. invisa* where ploughing under had more tillers (11.7) than mulch (10.1). Application methods of green manure did not significantly influence the number of tillers, panicle length and yield under *C. ochroleuca*.

Table 8: The effect of green manure application methods on growth and yield of rice.

	Kilasilo					Itope				
	Plant ht (cm)	Tillers/ plant	Panicles/ plant	Panicle length (cm)	Yield $kgha^{-1}$	Plant ht (cm)	Tillers/ plant	Pani./ plant	Panicle length (cm)	Yield $kgha^{-1}$
1	89.5d	7.6d	6.8d	17.6d	1767d	93.5d	9.2c	8.2d	18.0d	1597f
2(Mulch)	100.8a	10.0a	9.3a	21.1a	3403a	102.8b	11.7a	11.4a	21.1a	3061b
2(Plu)	96.6b	9.0b	8.9b	18.6c	3214b	107.2a	11.7a	11.4a	21.1a	3061b
3(Mulch)	94.2c	9.1b	8.6b	17.8d	2537c	103.1b	10.1b	9.4c	20.9a	2827c
3(Plu)	102.6a	9.4b	8.3b	19.3b	2667c	107.7a	11.9a	10.8a	18.2c	3285a
4(Mulch)	93.6c	7.9d	7.3c	17.9d	2532c	95.6cd	10.7b	10.0b	18.8c	2284e
4(Plu)	97.0b	8.6c	8.4b	17.6d	2607c	97.3c	10.8b	10.0b	20.2b	2553d
SE	1.30	0.20	0.21	0.30	55	1.35	0.26	0.23	0.35	55
CV (%)	4.07	6.87	8.09	4.91	6.16	4.02	7.33	7.09	5.49	6.08

Means in the same column for each site followed by a common letter are not significantly different from each other according to Duncan Multiple Range Test (P≤0.05)
Key 1= Control, 2 = *C. ochruleuca*, 3 = *M. invisa*, 4 = *C. obtusifolia*, Plu = Plough under

The residual effect of green manure on growth and yield of rice
The results in Table 9 show that the rice grain yield increased significantly (P≤0.05) under the influence of the residual effect of green manure in both sites. *Crotalaria ochroleuca* had significant (P≤0.05) taller plants than other treatments in both sites. Panicle count also increased under the residual effect of green manure in both sites. However, panicles were long under in plots applied with *C. ochroleuca* 21.6 cm, 21.7 cm followed by plots applied with *M. invisa* 19.9 cm, 20.3 cm and those applied with *C. obtusifolia* 19.0 cm, 20.1 cm in Kilasilo and Itope respectively. The yield under the residual effect of green manure was significantly higher (P≤0.05) than the control. In both sites *C. ochroleuca* promoted significantly higher yields than both *M. invisa* and *C. obtusifolia* in Kilasilo (1034 kg ha^{-1}) and Itope (1259 kg ha^{-1}) respectively.

Table 9: The residual effect of green manure on growth and yield of rice.

	Kilasilo					Itope				
Treat	Plant ht (cm)	Tillers/ plant	Panicles/plant	Panicle length (cm)	Yield $kgha^{-1}$	Plant ht (cm)	Tillers/ plant	Pani./ plant	Panicle length (cm)	Yield $kgha^{-1}$
1	82.2c	7.3a	7.0b	18.2d	799c	85.3c	7.3c	6.9b	18.2c	881c
2	95.8a	7.7a	7.7a	21.5a	1034a	98.8a	8.8b	8.6a	21.7a	1259a
3	89.1b	7.6a	7.6a	19.9b	918b	95.1b	8.6b	8.4a	20.3b	1134b
4	90.0b	7.9a	7.9a	19.0c	918b	93.3b	9.2a	8.8a	20.1b	1123b
SE	1.39	0.21	0.20	0.25	24	1.42	0.16	0.17	0.26	61
CV (%)	4.6	8.6	8.2	3.9	7.98	4.59	5.90	6.45	4.06	16.67

Means in the same column for each site followed by a common letter are not significantly different from each other according to Duncan Multiple Range Test (P≤0.05)

Key 1= Control, 2 = *C. ochruleuca*, 3 = *M. invisa*, 4 = *C. obtusifolia*

Discussion

Physical and chemical properties of the soils
The textural class of both sites is suitable for upland rice production, but due to poor fertility status application of organic/inorganic fertilizer is important to improve rice yield. On the other hand, the textural class for both sites favors the growth of *Striga* because they are sandy clay and are well drained. Heavy soils with poor drainage can have excess moisture that discourages *Striga* germination by lowering soil temperature and diluting the germination stimulant.

The soils are highly acidic, under strong to medium soil acidity, Al is highly soluble and can be toxic to the plants. On the contrary, the levels of Al in all sites are very low (trace). Probably the amount of Al in the soil combined with phosphates to form insoluble compounds hence low levels of Al. The parent materials can also be composed of low Al. The level of micronutrients in the soil is also low. It was reported by Landon (1991) that the level of micronutrients Cu, Fe, Mn, and Zinc under such acidic condition should be high or reaching the toxic levels. On the contrary, the results from soil analysis showed that the levels of micronutrients Cu, Fe, Mn, and Zinc are below toxic levels. Perhaps the parent material has low level of micro-nutrients hence little is released to the soil solution. The results indicate that soils in both sites do not supply rice with adequate amounts of phosphorus. This low P status can be due to low amount of available P, precipitation by Al, Fe, Mn, and by fixation of both oxides of Al, Fe, Mn and kaolinitic clays.
Organic carbon of soils at both sites is very low (less than 2 %), while nitrogen levels are also low (0.1 – 0.2 %). This shows that the soils from both sites need to be supplied with organic matter and nitrogen in order to improve the nitrogen reserve in the soil. The levels of CEC are medium and satisfactory for retention of cationic nutrients. The percent base saturation is 26 % for Kilasilo and 25 % for Itope. Both sites have percent base saturation less than 50 indicating that these soils are of very poor fertility. Soils with such a low fertility are susceptible to *Striga* infestation

because *Striga* grows well in soils of low fertility. Farmers are aware of this and use *Striga* as a bio-indicator of low soil fertility (Sauerborn, 1996). Low nitrogen levels and low organic carbon levels also contribute to the poor soil fertility that encourages *Striga* growth.

The soils in both sites are not ideal for upland rice production. They need amendments through the application of organic and inorganic fertilizers. The use of both organic and inorganic fertilizers is very important, because inorganic fertilizer provides nutrients for immediate use by the plant while application of organic fertilizer improves soil organic matter and nitrogen reserve for long time use. In addition, organic matter improves soil structure and physical properties like water holding capacity that has a negative effect on *Striga* infestation.

Weed infestation
Generally, green manure treatments reduced weed prevalence. Both the weed density and weed dry biomass in rice were significantly ($P \leq 0.05$) reduced when green manure was added in both sites. In Kilasilo, total number of weeds was reduced from 81.2 to 19.9 (m^2) Generally in both sites, the reduction of total weed number was 50.5% to 32% (m^2) whereas reduction in weed dry biomass was 54.6% to 51.4 % (m^2). This indicates that green manure has the potential to reduce weed infestation in upland rice fields. However, the potential of the green manure to reduce weed prevalence varied with the species used. The results indicated that grass weeds resisted the effect of green manure hence more grasses were recorded in green manure plots than broadleaf weeds. For instance, in both sites *C. ochroleuca* plots had 8% more grasses than broadleaf weeds, while *M. invisa* and *C. obtusifolia* had 14% and 10% respectively more grasses than broadleaf weeds. The resistance of grasses probably is a result of aggressiveness (Akobundu, 1987). Aggressive weeds are those with rapid seedling growth and wide tolerance to edaphic and environmental factors.

***Striga* count**
Green manures reduced *Striga* infestation in upland rice soils by reducing *Striga* number, In Kilasilo, *Striga* number was reduced by 100% in the 6^{th} and 12^{th} week in both sites. The reduction in infestation was the result of the potential of the green manure to induce germination of *Striga* seed to cause suicidal germination hence low *Striga* seed population in the soil. Another effect of green manure in the control of *Striga* was the release of nitrogen during decomposition. Nitrogen has a toxic effect to the *Stirga* seeds in the soil at the same time enables the susceptible host to tolerate or avoid the effect of *Striga*.

Rice growth and yield.
Green manure application improved rice growth and yield. In Kilasilo the yield increased from 1335 to 2846 kg ha^{-1}, the green manure species showed significance difference in the yield. The yield components also increased, plant height increased from 85 cm to 92 cm, number of tillers from 8.7 to 9.8, number of panicles 8.4 to 8.8 and panicle length from 18.7 cm to 19.4 cm. In Itope the grain yield increased from1238 to 2818 kg ha^{-1}, plant height increased from 90.0 cm to 97.6 cm, number of tillers from 8.7 to 9.8, panicle number 8.4 to 8.8 and panicle length 18.4 cm to 19.8 cm. Application of green manure upon decomposition released nitrogen for the rice plants. This increased the number of tillers per plant, number of panicles per plant panicle length and the grain yield (Murata, 1982). The improvement of yield was the result of nitrogen supplied by the green manure and the control of *Striga* in the field. Another contributing factor to the yield of rice probably was the organic phosphorous supplied by green manure. The amount of phosphorous in the initial chemical composition (roots and shoots) was *C. ochroleuca* 0.66%, *M. invisa* 0.66% and *C. obtusifolia* 0.74%.

Under green manure application methods rice yield was improved from 1767 kg ha^{-1} to 3403 kg ha^{-1} in Kilasilo. There was a significance difference between mulch and plough under in yield where, *C. ochroleuca* mulch (3403 kg ha^{-1}) appeared to be better than plough under (3214 kg ha^{-1}) in Kilasilo while other green manure species were not. In Itope also the yield increased from 1597 kg ha^{-1} to 3285 kg ha^{-1}. It was *M. invisa* and *C. obtusifolia* that showed a significant difference between mulch and plough under, where plough under was better than mulch.

Generally, the yield showed significance difference in green manure application methods except some few mentioned cases. This variation could be related to different processes in the soil. These include leaching of nutrients, nutrient mobility and decomposition of green manure roots which had a slow decomposition rate in the soil in both mulch and plough under plots.
The residual effect of green manure showed that the level of fertility fell drastically after one season, although the yield in green manure residual plots was higher than the control but it was lower than the previous season. Yield components showed poor response on the residual effect. On the other hand, the residual effect of green manure application methods was also poor. Therefore, the residual effect of green manure and green manure application methods are not effective in *Striga* infested soils of Kyela.

Experiment 2

Materials and methods

An on-farm farmer-managed experiment was conducted where rice and maize were grown in rotation with *Crotolaria* and pigeon pea in Kyela and Morogoro. Each farmer was a block, each block had 3 plots each planted rice/maize, Pigeon pea and *C. ocroleuca*. The following season all of the three plots were planted Rice or Maize to compare the performance of Rice or Maize grown after green manure with continuous cereal production.. Composite soil sample were collected from each farmer plots and analyzed as in experiment 1.

Rice yield (Kyela)
Table11 show the influence of green manure on rice yield over two years. The results showed that rice after rice produced the lowest rice grain yield. The yield of rice increased by more than 50 % when green manure was applied compared to the control plots.

Table 11: Upland rice yields for continuous rice and rice in rotation with C. ochroleuca or pigeon pea on demonstration plots in Kyela District in 2003 and 2004. *(n = 13) and 2004 (n = 15)*

	Upland rice yields (kg ha^{-1})	
Previous crop	2003	2004
Rice	1024	1141 ± 233
Crotalaria	2138	1968 ± 327
Pigeonpea	-	1340 ± 227
SED (12 df)	270	

Maize and rice yield in (Matombo-Morogoro)
Table 12 shows the yield of rice and maize in rotation with green manure compared to maize and rice grown continuously on a plot. The results showed that both the yield of rice and yield of maize increased when rice and maize were rotated with green manure. Maize yield increased up to 160% when rotated with pigeon pea while rice increased up to 126 % when rotated with *Crotalaria spp*.

Table 12: The influence of green manure on the yield of maize and rice in Matombo Mororgoro

Treatment	Kiswira village	Kibangile village	Kibangile village
	Maize yield in t/ha	Maize yield in t/ha	Rice yield in t/ha
Maize after Crotalaria	1.2	2.2	6.8
Maize after Pigeon pea	1.3	1.8	5.6
Maize after Maize	0.5	1.0	3.0
G Mean	0.98	1.67	5.13
SE	0.21	0.35	1.46
Range	0 – 2.4	0.4 – 2.8	2.4 – 10
Yield increase %			
Crotalaria	140	120	126
Pigeon pea	160	80	87

Achievements

Results of the research conducted on the use of green manure in Kyela the following were observed.

1. **Improvement of soil fertility:** Soils of Kyela have low fertility and high acidity these limits productivity. Therefore, application of green manure is very important in order to improve soil fertility. The improvement of yield and reduction of *Striga* infestation manifest the improvement of soil fertility.

2. **Improved yield of rice and maize:** Green manure applied plots had higher yield than the control plots. This is the result of green manure improve the fertility of the soil and reduction of *Striga* infestation.
3. **Reduction of *Striga* infestation:** The infestation of *Striga* was reduced by the application of green manure since they improve Nitrogen status of the soil which retard growth of *Striga* at the same time enable the host plants to grow vigorously to withstand or overcoming *Striga*.

4. **Reduction of other weeds:** The coverage of soil surface by the green manure resulted in the reduced infestation of other weeds apart from *Striga* although grass weeds resisted.

Conclusions

- Green manure application offers a potential for the control of *S. asiatica* and improve upland rice yield by the following ways
  - They reduced *Striga* seed population in the soil
  - They reduced infestation of weeds other than *Striga*
  - They improved soil fertility
- One-year application of green manure had a poor residual effect on rice yield and *Striga* infestation, the same applies for green manure application methods. Therefore, green manure application should be a continuous farm practice to ensure soil fertility improvement.

Acknowledgement:

We acknowledge DFID, SUA TARP II, for funding the project, Kyela and Morogoro District Agricultural Office, Farmers in the project area and members of the *Striga* Researchers team.

Reference: Anderson, J.M. and Ingram, J.S. (1993). Tropical Soil Biology and Fertility, A Hand Book of Methods. CAB International, Wellingford. Pp 45-49

Gomez,K.A. (1972). Techiniques for Field Experiments with Rice.IRRI, Los Banos Philippines. Pp52

Kanampiu, F.K., Ransom, J.K. and Gressel, J. (1997). Advantages of seed primed imizapyr for Striga hermonthica control on maize bearing target – site resistance. In: Proceedings of the 16th Biennial Weed Science Conference for Eastern Africa. (Edited by Adipala, E, Tusiime, G. and Okori, P) 15th – 18th September.WSSEA, Kampala, Uganda. pp 255-259.

Kayeke, J. (2004). Evaluation of the potential green manure and plant extracts for the control o f Striga asiatica on upland rice in Kyela, Tanzania: Phd Thesis, Sokoine University of Agriculture, Mororgoro, Tanzania

Kroschel, J. and Sauerborn, J. (1996). Farming Systems and the Problem of Applying *Striga* Control Methods - A comparison of case study from Northern Ghana, Tanzania and Malawi. In: Advances in Parasitic Plant Research. (Edited by Moreno, M. T., Cubero, J.I., Berner, D., Musselman, L.J. and Parker, C.) pp 845 – 853.

Mbwaga, A.M., Kaswende, J. and Shayo, E. (2000). A Reference Manual on Striga Distribution and Control in Tanzania. SIDA/FAO - FARMESA, Dar es Salaam, Tanzania Pp26

Ministry of Agriculture and cooperatives, (1998). Basic Data, Agriculture and Livestock sector. Dar es Salaam, Tanzania.

Muller-Samann, K.M. and Koschi, J. (1994). Sustaining Growth. Soil Management in Tropical Small Holdings. Margraf Verlag, Wekensheim, Germany. Pp485

Myers, R.J.K., Palm, C.A., Cuevas, E., Gunalilleke, I.U.N and Brossard, U. 1(1994). Synchronisation of Nutrient Mineralisation and Plant Nutrient Demand. In the Bilogical Management of Tropical Soil Fertility. (Edited by Woolmer, P.L. and Swift, M.J). John Wiley and Sons,Chichester, U.K. Pp81-116

Parker, C. and Riches, C. (1993). Parasitic Weeds of the World. Biology and Control. Castefield Press Limited. UK. Pp1 - 74 .

Discussion

Q: Why inorganic fertilizer was not covered in your results
A: The presentation focused on the green manure only but the information on inorganic fertilizer is available in the general report

Q: Why didn't you consider an edible cover crop like lablab
A: Decision to use a crop depends on the farming system of an area, in Kyela pigeon pea is used as edible legumes

Q: What is the adoption rate on the use of Marejea compared to other cover crops like pigeon pea and lablab.
A: The adoption rate is high because all participating and few non participating farmers had more Marejea than pigeon pea in their fields.

Q: What are the benefits of using Mimosa as a green manure in your experiment as we are aware that there are more disadvantages of using Mimosa than advantages.
A: Since Mimosa spp are weed in upland rice then the research on using it aimed at exploiting some potential of the leguminous weed.

Q: What is the right spacing for pigeon pea in relation to fertilizer improvement and Striga control.
A: The right spacing for pigeon pea is 100cm x 50cm and it is given in your leaflet provided

Economics of growing green manure in rotation with cereals for resource poor farmers. Case studies of Morogoro rural and Kyela districts

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Introduction

During the Green Revolution the emphasis was to increase agricultural productivity through modern technology such as fertilizer

•Till 1986 all farm inputs in Tanzania were provided to farmers at subsidized prices and distributed by respective regional/district cooperative societies

•From 1986 on, market liberalization saw both removal of subsidies and collapse of Cooperative societies

• Availability of farm inputs including fertilizer became difficult and these were too expensive to purchase. Effect of these policy changes are highlighted as follows;

•Declining soil fertility…..
•Build of diseases and pest…..
•Production started to fall:
–from 25 to 4 bags of rice per acre
–from 18 to 5 bags of maize per acre
•Productivity per area and labour also
•Low yield ---- low income ---- low saving --- low investment
•INCREASED POVERTY

Objective of the project

•Gathering from these; staff from ARIs Ilonga, Mlingano and Uyole, SUA, INADES, NRI, and Kyela and Morogoro rural District Agricultural Extension teams have been collaborating to develop and promote strategies that reduce the impact of *Striga* and declining soil fertility in rice and maize plots.

•Technology tested:

– green manure using ***Marejea*** and ***pigeon peas*** on rice and/or maize of **KYELA** (Kilasilo/Mbako; Itope; Sinyanga; Konjula villages) and **MOROGORO** (Kiswira and Kibangile villages)

•3-6 years have past since villages became involved in the project; several achievement have been recorded.

•Number of villages participating has increased from 4 to 8 in Kyela; and from 2 to 6 at Matombo

•Number of households participating in the project has tripled

•Schools are now participating

•BUT to date no economic analysis about the technology has been conducted. This reality necessitated us to conduct this study.

Methodology

•Review of existing literature (Uyole, SUA, Peramiho, Ukulima wa kisasa

•Conducting structured interview with farmers

The study was conducted in 2 villages

–Kyela (Kilasilo/Mbako)
–Morogoro rural (Kiswira)

•Discussion with key informants

–Peramiho (Br Herman, MRUMA centre)
–Farmers (Songea, Morogoro & Kyela
–Agric officers (Kyela, Morogoro,)
–NGO (Church, etc.)

Results

Rice field under continuous cropping

Continuous cropping

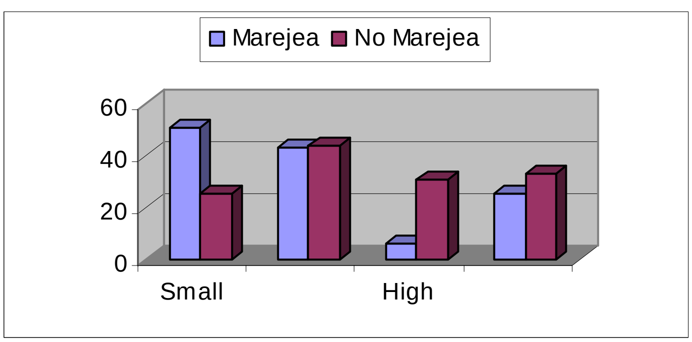
	Crop	Land pre	Other costs	Weeding (twice)	Harvesting (bags)	Revenue (tshs)
Year 1	Rice	12900		12185.2 8086.5	7.0	140,000
Year 2	Rice	12900		12185.2 8086.5	5.0	100,000
Year 3	Rice	12900		12185.2 8086.5	4.3	86,000
Year 4	Rice	12900		12185.2 8086.5	3.5	70,000
Year 5	Rice	12900		12185.2 8086.5	3.5	70,000

Rice planted in rotation with green manure (Marejea)

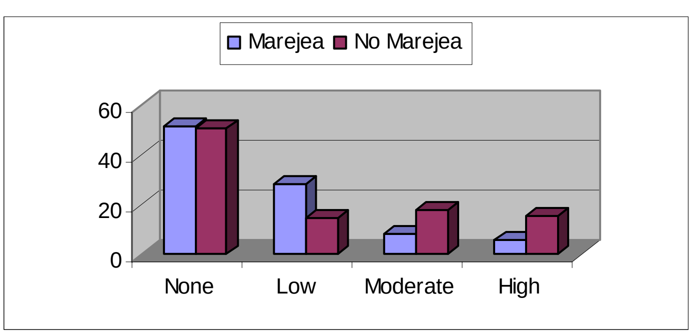
	Crop	Land pre	Other costs	Weeding	Harvesting (bags)	Revenue (tshs)
Year 1	Rice	12900		12185.2 8086.5	7.0	140,000
Year 2	Marejea	12900		-	0.5	25,000
Year 3	Rice	9900		8086.5	15.3	306,000
Year 4	Marejea	9900		-	0.5	25,000
Year 5	Rice	8700		8086.5	20.5	410,000

Other benefits of using Marejea; farmers' perception on

a) Effect on drought



b) Effect of *Striga* on crop growth



Proportionately respondents who plant Marejea comprise the majority who reported low *Striga* infestation. Similarly high proportion of respondents who reported high incidence of

Marejea comprise these without using green manure

Yield proportions

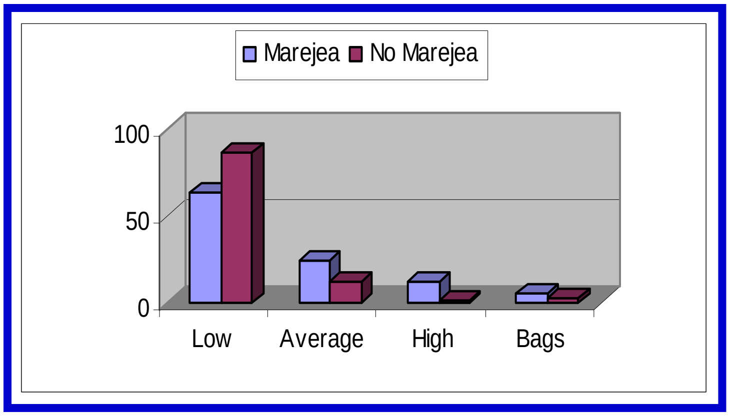


Figure shows proportion of respondents by number of bags harvested. Majority who did not use Marejea reported low yield, whereas the majority who reported high yields are those who use Marejea for soil fertility improvement.

Profit levels by production strategies

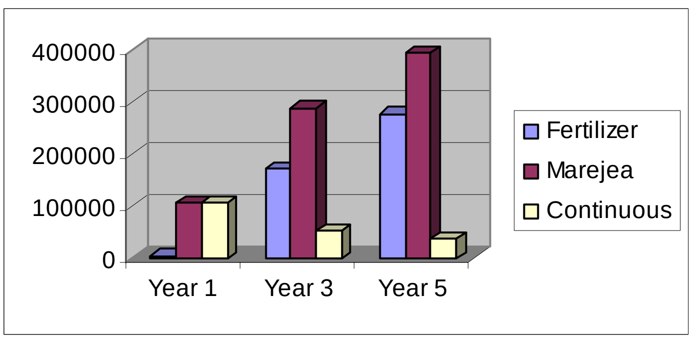
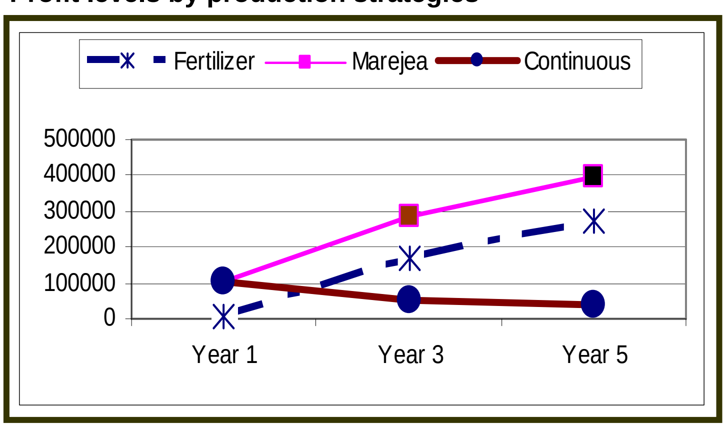


Figure show predicted profit levels over 5 years of using fertility improving technology. Profit is higher with Marejea followed by fertilizer at the 5th year.

Profit levels by production strategies



The graph show profit levels for 3 types of treatments intended for improving soil fertility. Continuous planting without any intervention lead to steady decline in profit. Application of fertilizer and Marejea tends to increase profit. However profit is higher with Marejea than when inorganic fertilizer is applied.

Conclusion and recommendation

- Except continuous cropping all other strategies leads to increased profit
- *It is more profitable to use green manure such as Marejea than inorganic fertilizers*
- There are several other none-financial or physical benefits associated to using green manure such as marejea
- *Slow build up of the benefits of using marejea can limit farmers to adopt the technology*
- Promotion and education
- Increased availability of marejea seed to many people for fertility improvement
- Research for more user friendly rotation to save time lost for crop growth during rotations
- Scalling up mechanisms to teach as many farmers as possible

Discussion

Q: More explanations are needed concerning the yield proportions

Q: Why costs of weeding are constant in all plots rotated with Marejea.
A: There was no weeding the whole season when Marejea was in the field.

Q: What does 0.5 mean in one of your tables?
A: That is the realized yields in bags.

Marejea in mid 70's to mid 80's and Factors that limited adoption and lesson learnt:

J.P. Hella

Introduction

- Sunnhemp (*Crotalaria* spp) or Marejea is a plant native to tropical regions where rainfall is high
- There are several species of *Crotalaria*, some are poisonous and others not
- In 1940 it was established that some species of *Crotalaria* grow wild in Tanzania
- Non-poisonous species, *Crotalaria ochroleuca* is good feed for livestock (Gerold, 1986)
- Use of Marejea for fertility improvement in Tanzania started in 1898 reached peak in 1980s

The Problem

- Evidence of use of Marejea for soil fertility improvement in Tanzania was recorded way back 1898
- In 1930s it was introduced in Songea by Benedictine fathers at Songea - Peramiho for fertility improvement and to reduce weed competition
- Research on various attributes of Marejea at Uyole and SUA in the 1980s indicated that about 80-120 kg N/ha accumulate in the soil after Marejea incorporation.
- In 1980s there was a remarkable campaign to use Marejea for fertility improvement.
- BUT wide spread on its use was limited to a few districts particularly Songea and individual farmers like late Mwalimu JK Nyerere farm.

The objective

- Staff from ARI-Ilonga, ARI-Mlingano and ARI-Uyole, SUA, INADES, NRI, and Kyela and Morogoro rural District Agricultural Extension team have been collaborating to develop and promote the use of Marejea to reduce the impact of *Striga* and improving soil fertility in rice and maize plots. These activities were in the following villages;
  - KYELA: Kilasilo/Mbako; Itope; Sinyanga; Konjula, Kandete, Lubanda, Ushirika, and Ngana.
  - MOROGORO: Kiswira, Kibangile, Ngozo, Mtombozi and Konde
-

Methodology

- **Discussion with key informants**
  - Farmers: Kyela, Morogoro rural; Songea rural districts
  - DALDOs: Kyela, Rungwe, Mbeya rural, Morogoro rural, Songea rural
  - Researchers: SUA, Uyole, Ilonga, Mlingano
  - NGO: Peramiho missionaries, MRUMA centre, Kiswira mission, Bigwa sisters

- **Literature review from various sources such as**
  - Uyole, SUA, Peramiho, and various documents provided by this project.

- **Questionnaire to farmers:**
  - Morogoro (Kiswira, Mtombozi, & Kibangile)
  - Kyela (Kilasilo, Mbako, & Lema)

Results

The research results are focused on three main issues

- History
- Extension methods used
- Current status

Results: History

- A native plant found in the wild & considered poisonous by natives
- 1898: Evidence of use for fertility improvement
- 1942: Marejea was brought at Peramiho
- 1963: Peramiho started experiments to control weeds using marejea
- 1983: Sunnhemp seed bank started at Peramiho
- 1980s: Extensive research at Uyole (Mkurasi) & SUA (Tucker and Ndunguru)
- 1987: MRUMA centre started
- 1990: About 64.5 tons of Marejea distributed throughout the country

Success story

- Mass production of sunnhemp at villages surrounding Peramiho (Morogoro, Butiama, Mpitimbi, Lipwatasi)
- Sunnhemp seed bank at Peramiho now available.
- Spread of Sunnhemp seed through out the country (free of charge)
- Sunnhemp displayed in agricultural shows
- Export of sunnhemp seed through out the world for trials (to 28 countries btw 1996 and 2004)

History: Farmers side

- Scanty information about the name - Marejea in all district visited except Songea rural
- The plant is known especially among the old ladies
  - Old days used for ear decorations
  - Poisonous if eaten by chicken
- Generally - knowledge about the plant came in recently years

Heard about use value of Marejea

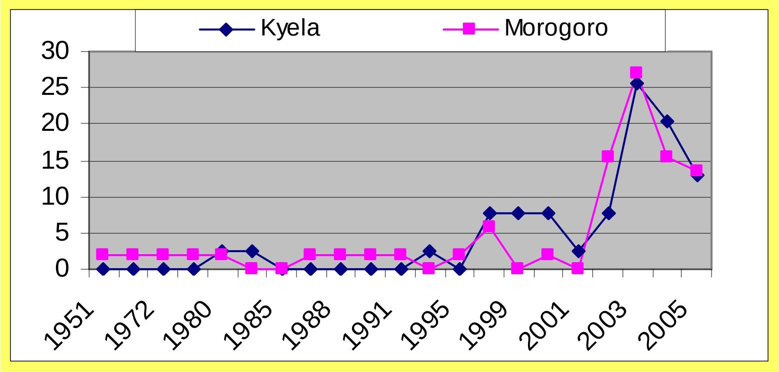


Figure shows proportion of respondents who heard about Marejea by years. Evidence shows that knowledge about Marejea started to pick up in 1996 with peak in 2003

Results: Extension methods

- Previously no specific approach was used: All DALDO's office visited remembered to have received seeds of Marejea in 1989 - 1990
- Spread based on individual interests: Missionaries, Late President Nyerere, MRUMA centre
- Research: On station research with limited on-farm research at SUA , Uyole, Ilonga stations
- On-farm without feedback to farmers

Poor uptake!!!!!!. These might have resulted into poor uptake of the technology.

Reason for poor uptake

- Existence of chemical fertilizer at subsidized prices

- Less likely since even in areas where fertilizer was not commonly used Marejea was also not used.
- Limited infrastructure; poor roads, bridges to reach rural areas
  - Yes and no: Similar usage close to urban and rural areas
- Extension approach??- very possible
- Research approach – very possible
- Low population:
  - there was room for shifting cultivation – very likely
- Lack immediate and direct economic benefit(s)

After 1998

Deliberate efforts and change in research approach was adopted, whereby on-farm research – farmer managed and farmer implemented approach was adopted

- Pilot villages in Kyela district
  - Kilasilo/Mbako
  - Itope
  - Sinyanga
  - Konjula
- After-wards (2001)
  - Kiswila (Matombo)
  - Kibangile

Approach used 1998 and beyond

- On farm experimentation - Multi disciplinary team
- Farmer as a researcher
- Farmer researchers' working in group
- Periodic evaluation by researchers and farmers
- Farmer exchange visit
- School involvement to impart knowledge on farmers of tomorrow (songs & poems)
- Leaflets and posters

This approach resulted to "Ari mpya, Nguvu mpya & Kasi mpya" in the use of Marejea to improve soil fertility and control Striga.

Current status

- Many villages in Kyela and Morogoro village have pioneer group planting Marejea in rotation.
- Many schools in both district have streamlined Marejea in their school activities.
- Farmer use the technology to increase soil fertility and control Striga
- Uptake of technology to many villages, schools, districts and regions

Conclusion and recommendation

- Despite earlier effort, adoption of the technology was very low. Approach used to promote the technology was not good.
- Some successes have been recorded with the new approaches of research and extension
- Uptake of the technology is much slower than the magnitude of the problem
- Go where the people are - Research/extension approach, involve farmers in identification of their problems.
- Training to equip farmers with new knowledge
- Plant green manure with some direct use value e.g. pigeon pea

Strategies of incorporation of *Striga* biology and control in school curriculum experience from Morogoro rural.

A.S. Mwegole
DED Morogoro rural district

INTRODUCTION AND INCEPTION OF THE PROJECT

Morogoro Rural is among the five District Councils of Morogoro Region. The District has a population of about 263920 according to the 2002 population and housing census. It has six divisions with seven Secondary Schools and a total number of 144 primary schools. Bwakira Division has 22 Primary Schools, Mvuha 23, Matombo 34, Mkuyuni 26, Mikese 14 and 25 Primary Schools in Ngerengere Disivion.

Matombo lies to the south of the Uluguru mountains which is relatively densely populated with a population growth rate up to 6.5 per annum. However, the project was introduced in Morogoro district by involving six primary school teachers. Those are Amos Fabian from Kibangile Primary School, Mr. Oswald Leo from Matombo, Mr. Shija, Joseph from Mlono, Mr. Longin Hassan from Konde, Mr Peter Fransis from Mtamba and Mr. Gabriel Mkumbo from Gozo primary school.

PURPOSE OF THE PROJECT

The purpose of the project was to improve soil fertility on *Striga* infested soils by introducing crotalaria (marejea) and control of witch weed (striga) on the fields of small holder farmers in maize and upland rice. Efforts were also made to explore the possibility of using agricultural primary school teachers to incorporate the knowledge of *Striga* in teaching curriculum for primary school pupils.

GENERAL OBJECTIVE

STRATEGIES USED FOR EXTENDING THE KNOWLEDGE OF CLOTALATIA IN THE CONTROL OF STRIGA

Six agricultural teachers from Kibangile, Mtamba, Mlono, Gozo, Konde and Matombo were involved in the first inception workshop of November, 2002 and second follow up workshop conducted in July 2003. The objectives of the workshops were to plan to incorporate awareness and management of *Striga* in school teaching programme. Specifically to obtain teachers experience on how they disseminate information to the community and , to let them understand the biology, effect of Striga on cereal crops and its control strategies.
The workshop enabled teachers to obtain experience on how they disseminate information to the society, to understand the biology and effect of *Striga* on cereal crops. To compare experiences of incorporating awareness on the use of green manure to increase soil fertility, and control of striga by crop rotation with green manure and hence to set strategies for implementation of the project objectives.

After the workshop the participants (Agricultural Teachers) used difference measures to include this knowledge in the classroom teaching. Within schools, the knowledge was disseminated to the head teachers and other teachers during staff meetings. In the classes, standard V – VII pupils learnt through skill study subjects whereby various methods used such as the use of actual materials, pictures, posters, books, choirs, brochures and leaflets. Standard I – IV also participated in skill study classes; whereby actual materials, pictures and posters used. Other activities used for extending the knowledge of *Crotalaria* in the control of *Striga* were through self reliance activities by introducing demonstration plots at schools. They started with plots of 5 x 2m where pigeon pea and *Crotalaria* were planted. Cultural entertainments were also used especially during graduation and parents' day.

In Inter – schools the knowledge also disseminated though the establishment of demonstration plots, practices and use of actual materials, schools visits, school to schools visits. Each participating school was obliged to perform a certain cultural entertainment like choirs, poems, drama and local dance. In so doing, Kibangile primary school prepared choir, poems, drama, and tradition dance. Konde prepared poems and drama, Mlono prepared tradition dance, Matombo prepared choir and poemas while Gozo primary schools prepared poems. Through these gatherings the relationship between schools, farmers and Government leaders which included village leaders, teachers, and technical (Extension workers) strengthened. In disseminating the technical information and knowledge, primary schools concerned involved in preparing demonstration plots, cultural entertainment distribution of bronchures, leaflets, posters and actual materials eg. Crotalaria seeds. Invitation to parents in meetings, parents day and farmers filed day and the visit of government leaders enhanced the spread of knowledge effectively.

ACHIEVEMENTS

For those schools involved in the project, the respective teachers gave a very positive account of their experiences of incorporation awareness of *Striga* biology and control (according to follow up workshop 2003). 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 (case of Matombo primary schools). Pupils and some farmers are now aware of what is going on in the project and the purpose of growing *Crotalaria*. Neighboring schools and community showed interest on the technology and appreciated the performance of the crotalaria in the field (case Mlono). The schools committees were taught about the *Crotalaria* technology. Through school committees, and village government meetings the information reached about 500 people (case of Kibangile primary school). Apart from cultural entertainment like choirs, drama, poems display of posters, leaflets and brochures, the results of demonstration plots encouraged farmers and other teachers to increase the size of their plots.

The schools also increased the size of their plots up to 23 x 70 m^2. and about 70% of pupils participated in the field work (Case of Mlono primary school)

The technology of using *Crotalaria* and pigeon pea to improve soil fertility was taught effectively in skill study classes. Standard V, Vi and VII were involved in the demonstration plots (case of Konde Primary School) Also 130 pupils of Std. V, Vi and VII from Matombo Primary schools participated in demonstration plots as well as skills study classes. Since soil fertility increased good crop harvests were achieved, and *Striga* and the number of weedings needed have been reduced. Neighboring schools have been attracted to this work. As a result, teachers, neighboring schools and farmers confidently decided to improved rice production by growing green manure.

CHALLENGES

From the above experience gathered during the project duration there were also some challengers encountered which are as follows.

- Demonstration plots were severely affected by drought (case of Kibangile and Matombo)
- Stray goats around the schools destroyed the crops (case of Kibangile) however, the head teachers took some measure to arrest the situation.
- Pigeon pea seed was stolen when thieves broke into the school premises (case of Gozo).
- Some of schools have not enough land (Case of Konde)
- Some neighboring schools and farmers were slow in accepting the technology because of poor accessibility to reach their farms due to geographical location (Case of Mlono)
- Time was too short to teach many farmers (case of Kibangile).

FUTURE PLANS

Encouraging management and committed members to participate fully in the project so that after 3 years about 75% of farmers will be aware of the benefit of the *Crotalaria* in improving soil fertility and controlling Striga. In order to improve relationship between schools, farmers, agricultural extension officers and teachers collaboration will be strengthened in order to extend the education to the society at large and improve agriculture practices. The schools will continue producing *Crotalaria* seeds as well as educating farmers on the advantages of using *Crotalaria* to increase soil fertility and therefore to control *Striga*. This knowledge will be extended to other divisions in the district through meetings of ward education Co-coordinators ward development committees meetings, and to the head teachers during the usual meetings. Our schools will be encouraged to expand their plots in order to have excess of *Crotalaria* seeds to give to neighboring schools, and other divisions. Displays will be made on "nane nane" day. Improving the productivity of school plots will it is hoped produce adequate grain for school mid-day meal. It is also planned to have school a competition in order to raise enthusiasm hence to make our schools centers of education for the surrounding community because it is believed that if you educate a school child you have educated three people, that is, pupil mother and father.

APPRECIATION

We would like to take this opportunity to thank and congratulate Dr. Charlie Riches on behalf of the United Kingdom, Natural Resources Institute, Researchers from the Sokoine University of Agriculture Morogoro, Mlingano Agricultural Research Institute, Tanga. Ilonga Agriculture research Institute and others who assisted on proposing and initiating the project in our district for the benefit of our community and nation at large.

Discussion

Q: Will the agriculture classes be taught despite the announcement made by the Minister for education?
A: The classes will be taught in Skill studies.

Q: How did your agriculture teachers to cooperate and how was the technology transferred to pupils.
A: There is a bylaw that governs the cooperation of teachers and how they teach in the classes.

Q: How many pupils have asked for Marejea seed. How many schools are practicing the technology and how many farmers got the technology from schools.
A: All schools under the project are practicing the technology and pupils are participating in their respective schools but the exact number farmers who got the technology from pupils is not known until the impact assessment done.

Q: What strategy have you set so that the remaining 144 schools are participating in the project.
A: The strategy is to cover ward after ward.

Q: Do you have enough means/teaching aids for the technology.
A: We don't have enough but we will use the available means

Q: What are the mechanisms for monitoring impact and the effectiveness of the approach used in disseminating the technology.
A: No answer was recorded

Q: Were the pigeon pea stolen from school used for food or for seed.
A: Since they were stolen when the store was broken it is not clear whether they were taken for food or not.

Q: What is the percentage of teachers within the project area have received the technology and what teaching aids were effective in conveying the message of Marejea technology.
A: We don't know the exact percentage of teachers outside the project, at the same time the teaching aids have not been assessed for their effectiveness.

Strategies of incorporation of *Striga* biology and control in school curriculum experience from Kyela

V.E. Mbena, DEO Kyela

THE PROJECT ON CROTALARIA IN KYELA DISTRICT

Kyela is among the seven-district council and one Municipal in Mbeya Region. The district has 99 primary schools although 15 primary schools teachers were involved in the workshop.

The project was introduced to our district in 2002. The purpose was to encourage Primary school teachers, Pupils and the community on planting and using *Crotalaria.*

Crotalaria known as Marejea in Kiswahili is used to increase soil fertility and control *Striga* (Kiduha). The weed is widespread in the fields of farmers and also in school farms. It attacks and reduces yield of upland rice and maize. To tackle this problem, it has been proposed that farmers grow rice in rotation with Marejea.

A number of workshops have been conducted by team of researchers from Ilonga ARI, Natural Resources Institute UK, ARI Mlingano, ARI Uyole and INADES FORMATION TANZANIA – Dodoma. Fifteen Primary school teachers participated these workshops. These teachers came from the following Primary Schools:- Nduka, Ngamanga, Nkuyu, Lema and Kisale. Other schools were Mbogela, Lugombo, Lukwego, Kyela, Kiwira Coal Mines, Lusungo, Kasumulu, Kandete, Mbula and Mbako. Another participants were:- The Ward education coordinators from Ikolo, Busale, and Lusungo Wards, the District education Officer (DEO) and the District Agriculture Officer (DALDO).

THE PURPOSE:

The main purpose of the workshop was to introduce to teachers to methods for improvement of soil fertility and control of *Striga* (Witch Weed) on rice or maize by rotation with green manure. Different methods were used to enable the participants to understand the biology and control strategies of *Striga* (witch weed). Each group was given a question to think about later to present during plenary session. The presentations based on *Striga* biology, their distribution, and their management.

The workshop participants were requested to avail knowledge to their schools by using songs, poems, drama, lecture and traditional dances. The use of real objects in classrooms and field demonstration plots was another methods of spreading the knowledge. All workshop participants were provided with *Crotalaria* and pigeon pea to be planted in school demonstration plots. Participants were advised to have three plots (demonstration) as shown below. After harvesting, next season all plots are to be planted with rice or maize. to allow assessment of *Striga* (witch weed) and crop performance in each plot.

CLOTARALIA	RICE OR MAIZE	PIGEON PEA

What has been done:-

After the workshop the message spread to other people such as pupils, teachers from nearby schools, school committee members and villagers. Pupils were encouraged to send the message to their parents and inform them about the knowledge on *Striga*. Some parents came to school in order to learn more about the impact of *Striga* and its control.

ACHIEVEMENTS:

Many Primary school teachers, Pupils and other parents now know about *Striga* and its effect on cereal crops. But before workshop some people used *Striga* as medicine to treat stomach problems, some used to decorate their houses. *Striga* posters displayed to pupils, teachers and some parents encouraged them to make use of *Crotalaria* in their fields in order to reduce *Striga* (Witch weed). Some farmers are now aware of what is going on in the project concerning *Crotalaria* and *Striga.*

In the coming season (2005) from July this year some of the Primary schools such as Mbako, Nkuyu, Mbula and Kandete are expecting to sell large amount of *Crotalaria* seed (600/= per Kilo). Teachers from nearby schools came to ask for seed. Therefore *Crotalaria* sales can benefit school funds.

Problems.

Participants encountered some problems while communicating this message to the community and other teachers.

- There was lack of seriousness to their fellow teachers.
- Some teachers demanded allowances to attend seminars.
- Lack of time to teach in Primary schools
- Some elderly people believed that "*Striga*" is associated with witchcraft that cannot be eradicated.
- Inadequate teaching and learning materials such as booklets, posters, leaflets etc.
- Farmers do not have extra land to plant green manure, a non-food crop

Results

- The results of demonstration plots confirmed that *Striga* affects mainly cereals like maize and rice.
- Pupils noted that yields were higher where maize was mixed with cow peas, than maize alone. This indicated that legume crops have ability to fix on root nodules.
- The message on how to control *Striga* by planting *Crotalaria* and pigeon pea has now spread to nearby schools and villages too.

Future Plans

- Pupils to visit other schools to share experience
- To send the message to the council by using songs, traditional dance, Poems, drama etc. in full council meetings.
- The knowledge of *Striga* to be available at all level of target population.
- Schools to conduct more demonstration plots using cowpea, *Crotalaria* maize and rice
- Parents, farmers, nearby schools, village leaders, school committee members to be invited in order to see the demonstration plots.

Suggestions.

- Ministry of Education and Culture to incorporate the knowledge on *Striga* biology and its control in primary and Secondary school curriculum.
- Agriculture experts to conduct more seminars and workshop on *Striga* and its control.
- To improve relationship between schools, farmers and government.
- Distribute many leaflets and booklets to all Primary schools.

Conclusion:

We would like to extend our gratitude to all researchers beginning with DR. A.M. Mbwaga (team leader) and other resource persons from ARI – Ilonga, DR. G. Ley from ARI – Mlingano, Dr.C Riches from NRI – UK, MR. P. Lameck from INADES – Dodoma and Dr. J. Kayeke from ARI Uyole.

We still call upon all researches to continue assisting our schools and community in order to control this witch weed (Striga) in our district and all over the country.

Thank you,

Discussion:

Q: Do you have a reliable source for seed supply

A: There is a sustainable plan for seed production in place

Q: Why only nine out of fifteen schools did well

A: Schools failed to achieve the targeted goal due to poor weather

District Strategies for dissemination of research results/products to reach wider audience in Kyela district

B. Abraham, DALDO Kyela

Introduction

For many years farmers in Kyela district have been growing rice as their main food and some of it for sale.

In recent years the yields of rice have been declining due to different reasons. The major reasons have been identified to include decline in soil fertility and an increase in infestation by parasitic weed, *Striga.*

Farmers, extensionists and researchers tried to tackle the problem first by inorganic fertilizers which reduced the number of *Striga* to 60 % and this resulted in a 45% increase in rice yield. Although the results were good, the practice was too expensive for many farmers to adopt. Backed with the knowledge of *Striga* infestation being attributed to low soil fertility the research team had to look for an alternative which will fertilize the soil and be affordable by many farmers.

Good lessons of the research

The research has resulted into many good lessons to farmers. These include;

(a) Farmers research groups have been established
(b) Exchange visits from one village to another within and outside Kyela District.
(c) Some Primary schools in the district have established the Marejea demonstration plots for their pupils and the community around the schools.
(d) Songs, poem, drama and plays have been composed by school pupils explaining the importance of and advantages of Marejea in rice production in Kyela District.

The results of the research

Since the inception of the research during the 1997/98 season when urea was used and later in 2002 with Marejea three main results have come out

(i) Soil fertility in the research site has improved significantly.
(ii) Infestation by witch weed (Striga) has been reduced to a great extent.

Farmers have achieved all these results with affordable cost. The technology is therefore suitable for farmers in Kyela district..

Strategy for wider spread of adoption of the technology, Marejea-rice rotation, in Kyela

Why Strategy

- Because any research starts with a sample of population and hence covering very small area while the outcome technology is required by whole community
- Because as it has been experienced that in several occasions that the end of all associated activities.
- To secure and mobilize resources (materials, financial and time)

Strategies

- Participatory evaluation of soil fertility status and the amount of rice harvest per area cultivated (Farmers will know their situation and the challenges ahead of them)
- Introduction of Marejea –rice rotation system in rice production cycle on a dialogue, advisory and education system as one of the option towards improving rice harvest
  =The farmers will know the biology, functions and advantages of Marejea
- Sensitization on the establishment of new farmers groups.
  =This will make the dissemination process of the technology easier and more practicable

- Involve the current farmer research groups and primary schools in the dissemination process of the technology (New farmers will get practical experience from fellow farmers and primary schools)
- Encouraging exchange field visits among village farmers within and outside Kyela District.
  =This will enable farmers to exchange experience and discuss their problems
- Having many primary schools and other community institutions involved practicing Marejea-rice rotation system in rice production.
  =This will increase the number of children who will teach their parents and employ the technology after school life.
- Conducting workshops with Ward Development Committee members and village government leaders.
  =The sensitization to get back-up and pressure from policy makers.

Expected problem during the dissemination of the results

1. Shortage of resources especially funds
2. Unreliable weather conditions for rice production
3. Long time for farmers to put into practice of whatever they grasp from the technology
4. Short supply of farm inputs and implements to farmers.

Discussion

Suggestions: 1. There is a need to identify other stake-holders so that they can contribute to the promotion of Marejea to the whole District.

2. Policy makers in the District would be invited to take part fully in the workshop instead of take pat in the opening and closing events only.

District Strategies for dissemination of research results/products to reach wider audience in Morogoro region

I. Ishuza, DALDO Morogoro

INTRODUCTION

Area

Morogoro District Council has an area of 11,925 Sq kilometers. 60 percent of this area is occupied by forests and game reserves. The potential area for agriculture is 8943.75 sq kilometers and only 2,981.25 sq kilometers is utilized for agricultural production.

Population

The District has a population of 263,920 people (according to 2002 census) with 56,723 households.

Economics Activities

About 90 percent of the people depend on agriculture for their Livelihood.

- The main crops grown are Maize, Paddy, sorghum, cassava and banana for as both food and cash crops. While fruits particularly citrus, pineapples, jackfruits and bread fruits are grown as cash crops. Other crops grown as cash crops are sesame and spices.

Livestock; The District has an area of 7000 sq kilometers which is suitable for grazing but only 840 Sq kilometer is being utilized.

The number of livestock kept is as follows:-

Indigenous cattle	-	30,718
Dairy cattle	-	2,769
Goat	-	26,268
Sheep	-	5,186
Pigs	-	2,744
Poultry	-	219,916

Climate

The District has a bi-modal pattern of rainfall. It receives short rains from October to December and the long rains from mid February to May. The rainfall ranges from average of 600 – 1900mm per year depending on altitude and geographical location.

Administrative Area

The District has six Divisions, 45 Wards and 134 Villages.

AGRICULTURAL PRODUCTION CONSTRAINTS

- Unreliable rainfall
- Lack of input shops in the villages
- Practicing unimproved crop farming technologies
- Disease and pests infestation
- Poor marketing of agricultural produce
- Poor soil fertility
- *Striga* infestation in some areas
- Inadequate extension services.

PROJECT BACKGROUND AND PROJECT RESULT

Project background

The project started in the year 2002/2003, in Matombo Division. The division was chosen because farmers do grow upland rice and experience the problem of poor soil fertility and high infestation of *Striga*.

The results shows that there has been an improvement in yield performance of both Maize and Rice in fields were Maize or Rice were grown in rotation with green manure (crotalaria or pigeon peas). Also the level of *Striga* infestation has been minimized. The number of weddings also decreased from two to one.

STRATEGIES FOR DISSEMINATING RESEARCH RESULT

- To facilitate farmers from the project area to participate in the coming Agricultural show in order to give them an opportunity to discuss with their fellow farmers on how they have managed to minimize *Striga* infestation.
- To conduct a survey in other areas of the District in order to find-out if there is any *Striga* infestation and if so to make them aware of the ways to overcome the infestation. Video shows will be used
- To organize farmers exchange visits i.e. farmers from other areas within the District to visit the project area in order to learn from their fellow farmers.
- The organize a workshop for the Village Extension Officers and ward Executive Officers in order to inform them about the project results.
- To encourage farmers in the project area to grow crotalaria and pigeon pea seeds and sell to interested farmers.
- To sensitize the farmers in the project area to train farmers in the other villages with the problem of *Striga* infestation and FFS methodology will be used.
- To collaborate with other extension providers e.g. MVIWATA, WCST, CARE International and WORLD VISION.

The role of Information Communication in technology transfer

J. Mika
Zonal Communication officer, Central Zone, Dodoma

COMMUNICATION TECHNOLOGY

•Communication

•Communication is the art of giving or giving and receiving information, signals, or message in anyway as by talk, gestures, or writing.

•Communication• Ie.
The transfer of information from the one person to another (source to receiver).

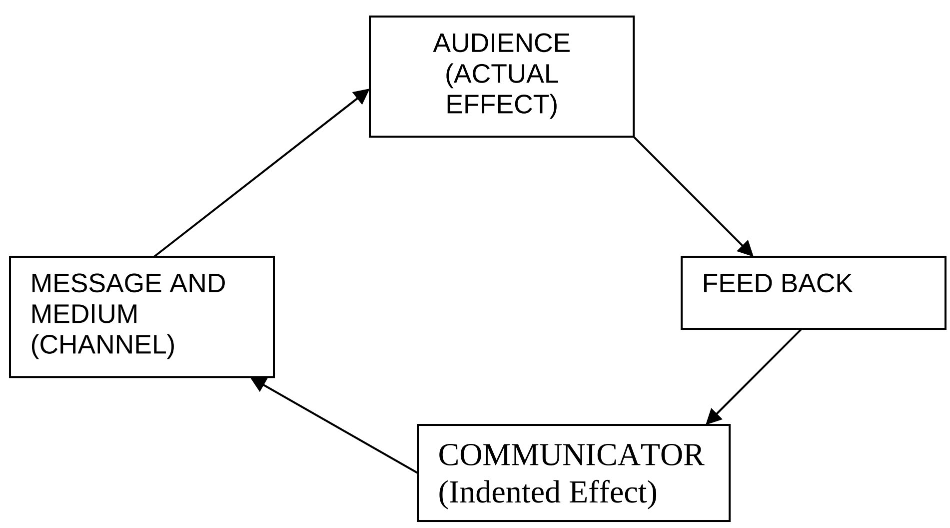
•Aim of Communication•

•To make the scientific knowledge or information available to village level (receiver) in understandable and useful way.

•How Communication works

•Public speaking - Having a meeting to tell something
•Mass Media- Means of transmitting message eg. Radio, Tvs, news papers, video
•Teaching materials- Blackboard, photos, posters etc.
•Reports

THE PROCESS OF COMMUNICATION



Why study these methods
•**Who says**- The source of information
•**What-**What the message carries
•**To Whom**- Who receives the message
•**Through what channel-**eg. Speaking, mass media etc
•**With what effect-** The outcome (feedback) which indicates the audience response to the communication.

There are two types of feedback
••(a). *Positive feedback-*
Reinforcing (strengthening) good performance and behavior
•(b). *Negative feedback-*
Correcting and improving poor performance and Behavior

Communication Strategies

Development and promotion
•The first thing to consider before developing any communication technologies/ strategies you have to conduct a survey on the existing communication strategies, the once to be improved, new once to be developed, obstacles in communication, and possible solutions, also learn on the following:-

During survey consider the following
•Basic needs/interest
•Economic level of the client area/living standard
•Believes
•Age
•Religion
•Educational level
•Occupation
•Gender
•Geographic location

Communicator
•Communicator is the one who extends the knowledge from the source to the receiver, therefore he/she must be ***proficient in technical knowledge***, or *what to communicate/teach*, ***educational process or*** *how to teach*, ***the use of teaching methods and his approach to village people.***

Process of diffusion
•According to the process of diffusion , people will normally have to undergo through the following stages of mental development before a new idea is accepted and put into practice.

•Individual mental development
•(a). *Awareness-* Know that it exist
•(b). *Interest-* Become interested in the new idea
•(c). *Evaluation-* Decides whether or not the new idea is good
•(d). *Trial-* Tries out the idea, usually in a small way
•(e). *Adoption-* Changes to the new practice.

•Effectiveness of communication channels

•There is a large number of channels of communication one can use, but to be most effective, they have to be selected according to where people are in these stage of adoption.

••In general, communication methods/ channels can be classified into three groups as follows:

Mass communication/teaching methods

•All those of means of transmitting messages involving mass media
eg. Radio, films, newspapers, news story, videos, Tvs, circular letters, leaflets etc.

•Characteristics

This enables a source of one or few individual to reach an audience of many.

•These methods are mainly for the purpose of getting awareness and interest of the people on certain idea

Group/communication/ teaching methods

•This method assist in moving people from the awareness step to the interest and sometimes to the trial stage of accepting new idea.

••They include general meetings group discussion, result demonstration, method demonstration, exhibition, and conducted tours.

Characteristics of group method

•When a new idea is presented to a group, the participant may ask questions, exchange ideas, and stimulate each other to action.,

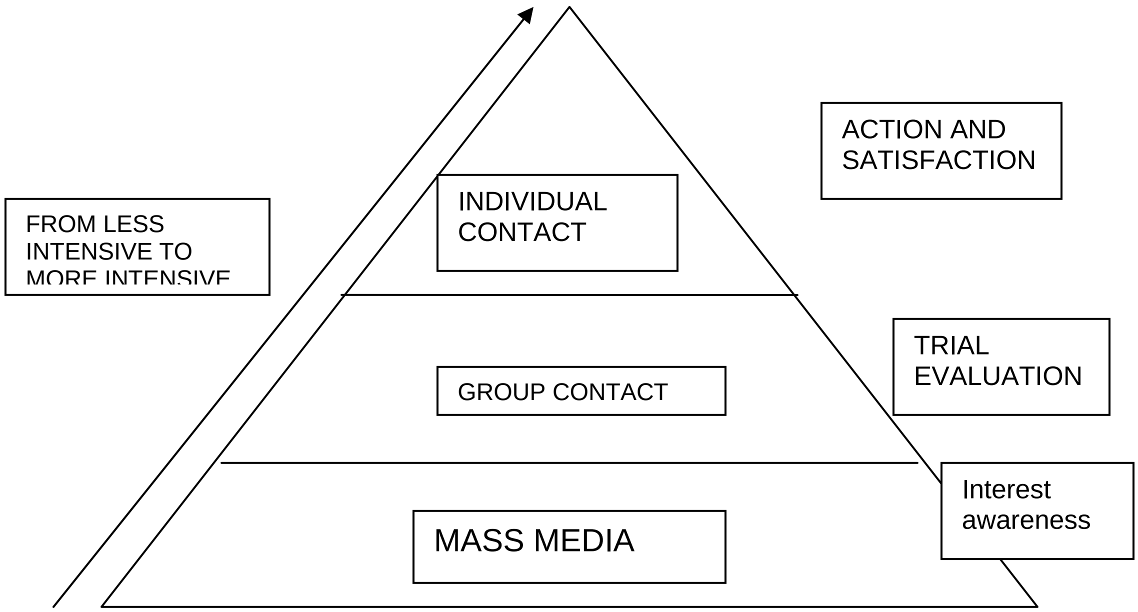
Individual/communication/ teaching methods

•Although much of extension teaching is done in groups, learning is an individual process. In many instances individual contact are necessary in order to get a farmer to adopt a new practice. The extension worker must know the farmer and his situation well and have his confident, before he/she can convince him to adopt a new practice

Individual contact include

•Farm visits, home visits etc.

•The whole process of diffusion in relation to the different methods of extension teaching mentioned above can be illustrated in the following diagram.



Process of diffusion in relation to different Communication/Extension teaching methods

Discussion

Q: How can farmers trust the newspapers since most of the news reported are for leisure not for agriculture related technology
A: Research is important in order to know which method suit a certain place. All means of mass communication are generally effective in conveying information

Q: Your presentation was more of making us know about communication while we expected to hear research results in respect to communication of Striga research. Did you do any research on this aspect.
A: I was not doing research rather documenting the communication channel used in dissemination of Striga control technology

Q: How can learning in a group be termed individual learning.
A: Learning in a group is recommended but the decision to adopt a new idea is done individually after going through the adoption stages

Q: In the course of the project implementation which communication method was more effective than others in the project area.
A: Feed back on the effectiveness of the method will be given by the end users who are the farmers.

Q: Have the project think of assisting the extension officers with communication facilities
A: They are advised to use the available means at their disposal.

Workshops' Key Messages

C. Riches, NRI, UK

Introduction

Striga and soil fertility decline

- Rice yields in Kyela and Matombo declined by 30 to 70% in past 20 years
- Due to population pressure opportunity to fallow has greatly been reduced
- *Striga,* thrives on cereals where soils are low in nitrogen
- *Striga* indicates that soil fertility has declined

►Farmers harvest low yields of hill rice every year in Matombo

►Poor crop stands, low vigour associated with low organic matter, low N and *Striga*

►Nutrient stressed rice a common sight in Kyela

►Once again with severe infestation by *Striga*

KEY MESSAGE 1

Striga in rice and maize indicates land that has been under cultivation for a long time with little addition of manures/fertilisers so farmers need to address soil fertility to restore productive use of the land

Vigorous rice growth and increased yield after green manure

Maize also responds well to Marejea

Pigeon pea also restores soil fertility

KEY MESSAGE 2

Soil fertility can be improved and yield decline reversed by adopting a legume-cereal (rice or maize) rotation

Added advantage of Marejea is reduced weed infestation and therefore less labour when weeding the following rice crop

Marejea seed is easily multiplied on-farm and spreads rapidly from farmer to farmer – 10 farmers in Kyela passed seed to 37 others in 2004

KEY MESSAGE 3

Marejea seed supply easily established and maintained at village/farmer level. Seed spreads rapidly in community by gift or sale.

Farmers most likely to adopt green manures after group exchange visits and field days “learning by doing”

Community awareness enhanced by well placed demonstrations at primary schools and other school activities

MESSAGE 4

The extension process used to promote cereal-legume rotations is as important as the technology itself!

Strong farmer leadership of groups well supported by VAEOs is vital.

Exchange visits to neighbouring villages, farmer led demos and an associated school programme contribute to spread of knowledge and adoption.

To support promotion through training of trainers there are now:

- leaflets
- posters
- videos
- pictorial training manual

RESEARCH FARMER'S GROUP – KILASILO VILLAGE
KYELA DISTRICT

Asegelisye Mwaseba,
Farmer, Kilasilo village

SHORT HISTORY

The group has started on 28.01.1979 by 9 farmers in response to the call of Dr. A. M. Mbwaga from ARI-Ilonga Kilosa. At the moment our group has 26 members.

Purpose of research

For a long time rice production in the village has been affected by *Ramphicarpa spp* in low land and *Striga spp* in upland rain-fed. When these weeds are not controlled, there can be up to 100% crop yield loss.
The research aimed at improving soil fertility so as to control the effect of *Striga*.

Methodology

The research started in 1997/98 season by using UREA to improve soil fertility in small plots of (5mx5m) in *Striga* infested fields; this was done for three years up to 1999/2000.
Results showed that rice crop was good in the plots applied with Urea compared to the control plots
Although the results were good but it was realized that the use of Urea was not a long term solution for the *Striga* problem, since fertilizer was too expensive to be afforded by majority of the farmers in the village. Therefore we started using Marejea which was brought by Dr Mbwaga for the purpose of fertilizing the soil from 2000/2001 to date.

The use of Marejea gave excellent results; the rice yield has increased tremendously. The plot of 5mx5m that has been fertilized by Marejea gave the yield of 7kg of rice compared to 3kg of rice from unfertilized plot. Our goal is to produce 20 bags of rice per acre instead of 3 bags which we are currently harvesting.

Success:-

There are many advantages of using Marejea these are

- Increases soil fertility
- Reduces the effect of *Striga* on rice crop
- Reduces weed intensity
- Increases the yield of rice
- No soil destruction like organic fertilizers
- They are cheaper in price and easy to transport than inorganic fertilizer.
- It easy to grow Marejea

Problems:-

- Lack of agriculture implements in our research group e.g. ox-plough and spray pumps.
- Unpredictable weather
- Crop prices are low and are still declining

Future plans

In order to ensure sustainability of our group we have registered the group as a Credit Society. Also the group is planning to increase the use of Marejea, pigeon pea and Canavalia spp to improve soil fertility.

Suggestions

- To educate fellow farmers the use of Marejea and we request the District Agriculture officer to give support and assist in educating farmers about use of Marejea
- We request the District Council to establish a farmers training center so that farmers can improve agriculture.
- Researchers should have a special technology for soil fertilization, for example some advocate the use of rice husks, some animal manure, some inorganic fertilizers. But we have Marejea as a savior for resource poor farmers since it costs less than other technologies
- Farmers in the District must be motivated encouraged to practice improved technologies especially the use of Marejea.

Acknowledgement

We extend our sincere thanks to Dr Mbwaga, his research team, District Agriculture Officers for the job well done to educate and work with us in this project.

We request Dr. Mbwaga and his team to work close to us because *Striga* is still a problem

Thank you very much

PLENARY SESSION:

Introduction:
The session was facilitated by Mr. LTH Nsemwa. Initially four groups were formed these were for Researchers, Teachers, Extension officers, NGOs and farmers.

The terms of reference were
1. How will the knowledge Marejea reach others
2. How will this process incorporated in daily responsibilities
3. Who will lead this process
4. How Marejea seed availability will be sustainable
5. What assistance will be needed to disseminate marejea technology to reach more people

Group presentations

Teachers

Question	What	How	By who	When	Source of funds
How the knowledge on Marejea will reach others	Training	The education on *Striga* and Marejea to be incorporated in school curriculum	-Teachers -Pupils -Education officers in schools/Wards/Districts	October 2005	Schools/Wards/District councils and NGOs
	Demonstration plots	Every school must prepare a Demonstration plot	Teachers and pupils	October/November 2005	Schools
	Cultural activities	Choir, drama and poems	Teachers and pupils	Farmers day, Parents day and other open days	Schools and Wards
How this process will be incorporated in the daily responsibilities	Part of some courses S/Kazi and M/Jamii	Teaching in classes std V – std VII	Teachers, Pupils, DEO and School inspectors (MEK)	School timetable	Schools, Wards, Districts and NGOs
Who will lead the process	Leading the process	Monitoring and evaluation of the implementation	Agriculture teachers, Head teachers, MEK, DEO, School inspection department	Following school terms	Schools, Wards, District councils, Primary school inspection department and NGOs
How Marejea seed availability will be sustainable	By increasing the area under Marejea from 0.5-1 acre	Each school must have a seed multiplication plot	Teachers and pupils	January/February 2006	Schools
What assistance will be needed to disseminate marejea technology to reach more people	Technical advise Research	Monitored, visited and given technical advice	Extension Officers	After every three months	Schools, Wards, District councils, SUA, MAFS and NGOs

Farmers

Question	What	How	By who	When	Source of funds
How the knowledge Marejea will reach others	To educate others	Village and sub-village meetings	Research farmers	From today 21st June 2005	
How this process will be incorporated in the daily responsibilities	The process will be incorporated through villages	By formal and informal gatherings/meetings	Research farmers and village leaders	From today 21st June 2005	
Who will lead this process	Research farmers	To make follow up to participating farmers	Research farmers and village leaders	From today 21st June 2005	
How Marejea seed availability will be sustainable	Increasing the size of seed production plots	Request all participants to have seed production plots	All participants	From today 21st June 2005	
What assistance will be needed to disseminate marejea technology to reach more people	Through mass media, letters and invitation to attend meetings	By requesting from Extension officers, Researchers and other stake holders	Village government	From today 21st June 2005	GOT

Non Governmental Organization

Question	What	How	By who	When	Source of funds
How the knowledge Marejea will reach others	Dissemination of Striga control knowledge	Strengthening linkage between research, Government institutions and NGOs To empower farmers groups which are have started practicing the Striga control	-Research Institutes, -Government institutions eg DALDO, DEO -NGOs DALDO and NGOs	Immediately Immediately	Responsible Government institutes and NGOs DALDO and NGOs
How this process will be incorporated in the daily responsibilities		NGOs must participate in Districts development plans NGOs must give priority to the Striga control	District Councils (DED) and NGOs	Immediately	District Councils and NGOs
Who will lead this process		By Identifying responsible institutes Having meetings	District Councils (DED)	Immediately	District Council
How Marejea seed availability will be		By using farmers groups to form a Marejea seed	DALDO and NGOs	Immediately	DALDO and NGOs

sustainable		bank			
What assistance will be needed to disseminate Marejea technology to reach more people	Assistance needed	Availability of the research findings, brochures, posters and leaflets/booklets	Research Institutes and DALDO	Immediately	Research Institutes

Extension Officers

Question	What	How	By who	When	Source of funds
How the knowledge on Marejea will reach others		Exchange visits	Farmers, Extension officers, Researchers, NGOs, Teachers and pupils	March-April 2006	District Councils MAFS NGOs
		Farmers' Days		March-May 2006	District Councils
		Agricultural Show (8'8)	Farmers who participate in the project	August 2005	District Councils
		Brochures	Farmers Invited guests Researchers	2007	District Councils and MAFS
How this process will be incorporated in the daily responsibilities		To put the control of Striga by using Marejeaa in the Department plans	Agricultural officers in the District	From July 2005	District Council Central Government DADPS
Who will lead the process			DALDO	From July 2006	
How Marejea seed availability will be sustainable		To maintain Marejea plots for seed production	Farmers Extension officers Researchers	2005/2006 Cropping season	Farmers District Council NGOs PADEP
What assistance will be needed to disseminate marejea technology to reach more people		-Research must continue -Training -Preparation of Brochures, posters and equipment like cameras -Transport -Funds	Researchers Farmers District Council Donors NGOs MAFS	July 2005	District Council Donors NGOs MAFS

Researchers

Question	What	How	By who	When	Source of funds	Remarks
How the knowledge on Marejea will reach others	Production of Leaflets, posters, training manuals and video	Reprint existing materials according to demands	Agricultural Research Institute Ilonga	When demand arise	EZCORE Clients like District Councils and NGOs	
	Evaluation and promotion of other legumes	Participatory on-farm trials and demonstration plots	Agricultural Research Institute and farmers	July 2005	DADPs ASSP PADEP/Mlingano ASARECA	Researchers to develop proposals
	Creating awareness to other Districts	Stakeholders workshop with Districts	Agricultural Research Institute	July 2005	ZAF EZCORE PADEP	
How Marejea seed availability will be sustainable	Seed maintenance and supply	On-station seed multiplication	Agricultural Research Institute	2005/2006 Season	GOT funda(O/C) PADEP, EZCORE	
What assistance will be needed to disseminat e marejea technology	Developing resistant/Toleran t varieties for maize and rice and continuing participatory evaluation of Striga resistant/tolerant varieties	On-station Trial	Agricultural Research Institute and International Research Institutes	2005/2006 Season	GOT funda(O/C) for ongoing trials ASARECA and other donors for the new projects	Develop research proposals ARIs

Discussion

Teachers

Q. Under the question who will lead the process, one person should be identified i.e one office that will take responsibility
A. DEOs and School inspectors (MEK)

S. Question 3 under the section “Who” research must be included

Q. What is the strategy to reach schools which were not under the project
A. Since DEOs and MEK will be involved then schools which were not under the project will be reached

S. Advice and assistance from DALDOs office will be needed to fulfill other activities.

2. Farmers

Q. How will marejea seed from group multiplication plots be provided to other farmers? Will it be sold or given free? If sold who keeps the money raised
A. The group will have a common shop where all farmers would come to bring their seed and sell to others and each farmer will be given money according to the amount of seed they brought to the shop.

S. In order to incorporate the process in daily activities Striga problem must arise as a problem in the village this will make easy allocation of funds from District Council for research services (Kyela DALDOs office promised to make follow-up on funds)

Non Governmental Organization
No comments/questions raised to the group.

Extension Officers
No comments/questions raised to the group
Researchers
Q. Since research objective is to ensure that technology reach as many farmers as possible why you have indicated provision of leaflets etc "when demand"
A. Currently the research is demand driven, client oriented

Q. When will DALDOs start to contribute towards research to solve major problems facing agriculture in their Districts
A. When they are made aware and when they are assisted to identify prevailing problems
S. There is a need for research Institutes to collaborate with other stakeholders to lay on-farm seed multiplication plots for the purpose of enhancing collaboration

Q. PADEP is not operating in many Districts is it not possible to support/finance activities in the District where it is not operating
A. It is not possible but in collaboration with ARI-Mlingano some activities related to soils can be financed

Q. On-farm trials can be supported with other materials such as leaflets to make use of various means of technology dissemination
A. Other means of technology dissemination will be employed because no single means is 100% effective

The way forward:

Towards the end of the workshop, participants agreed to form a team which will be monitoring and evaluating activities which were undertaken by the project. The major task of the team is to make sure that the technology is promoted to reach as many farmers as possible in each zone. To coordinate on the availability of Marejea seed and to make sure the councils put some money to facilitate the process of technology dissemination. Two teams were formed, one for Eastern and the other for Southern Highland zone. The composition of the teams is as shown in the two tables below, with representation from district extension staff, NGOs, District education officers (DEOs), farmers and researchers. The team has agreed to meet in January 2006 to evaluate the progress.

The use of the technology is considered to add to the strategies of ensuring food security and alleviating poverty to the resource poor farmers, who cannot afford to purchase agricultural inputs such as inorganic fertilizer.

1. Eastern zone

NAME	TITLE	ORGANIZATION	CONTACT
Mr. O. M. Ishumi	Chairman	ZRELO Eastern Zone	0748378988
S. Ruheza	Secretary	CARE International-Morogoro	0744862010
E. Masangya	member	DALDO office –Morogoro	0744026770
Ali S. Mwegole	Member	DEO Morogoro	0748816385/0746437448
Deonatus F. Daru	Member	Farmers from Kiswira - Matombo	-

2. Southern-Highlands zone

NAME	TITLE	ORGANIZATION	CONTACT
E. Kiranga	Chairman	ZRELO Eastern Zone	O744446233
Patrick Mwalukisa	Secretary	IRDTF – Ileje (NGO)	-
B. Abraham	member	DALDO Kyela	0744880482
V. Mbena	Member	DEO's office Kyela	0748380640
Asegelisye Mwaseba	Member	Farmer from Kilasilo - Kyela	0744203727

CLOSING SPEECH

Ms S. P. Linuma
Kyela District Executive Director

Zonal Research Coordinators, Eastern and Southern Highlands zones
Project Coordinator
Donor representative,
Zonal Research Extension Liaison Officers Eastern and Southern Highlands zones,
Zonal Communication Office Central zone,
DALDOs Mororgoro and Kyela,
Representatives of various Institutes
Care-Morogoro, UMADEP, PADEP Morogoro vijijini, ADP-Mbozi and IRDTF-Ileje,
District Education Officers,
Agriculture officers Kyela and Morogoro rural
Ward Education Coordinators
Farmers,
Ladies and gentlemen.

May I take this opportunity to thank you for inviting me to close this 2-day workshop. These two days you had a lot to do because the involved releasing results of the research which was done by farmers who were closely supervised by Researchers and extension officers. These results are to be disseminated to reach more farmers.

Dear participants, agriculture are the main source of daily needs, and development of our country. Therefore, there is a need to overcome agriculture production constraints and create conducive environment so that (Workers, businessmen, small scale and large scale farmers) farmers can produce economically.

Dear participants the great percent of the revenue of most of District Councils and the nation as a whole depends on agriculture sector for the economy and employment. I therefore call upon all participants to put into practice what you have learned and what you have declared in these two days workshop.

I know you have set a number of strategies that direct dissemination of the technology of using legumes (marejea) to fertilize farmer's fields within and outside project areas. I m told you had a plenary session where you discussed how the technology will reach more farmers outside the project areas. Also you have discussed how the process of technology dissemination can be incorporated in your daily responsibilities and those who will lead the process. All together you discussed how the availability of Marejea seed can be sustained and what assistance will be needed to scale up the technology and the source of funds since the project is coming to an end.

All good things need a special push in all working areas. Participation of all stakeholders is the best way to implement what has been agreed. Let us look in the positive way the problems that can crop up so as to solve them.

Dear participants, together of all issues discussed their implementation depends greatly on the acceptance of the farmers. I argue you to do whatever possible to motivate farmers so that they can accept what is taken to them for the betterment of the farmers and the national as a whole.

Lastly may I wish you a nice trip to those coming from outside Kyela District, and I declare the workshop closed. Thank you for listening.

Appendices

Appendix 1: STAKEHOLDERS WORKSHOP PROGRAMME 20 – 21 JUNE 2005 KYELA

Day 1:19th June 2005		
Time	**Activity**	**Responsibility**
1600 HRS	Arrival of participants	Dr J. Kayeke

Day 2: 20th June 2005 **Chairperson: Assistant Director Research** **Raporteur: Information Officer from MAFS**		
Time	**Activity**	**Responsibility**
0800 – 0900	Registration	Participants
0900 – 0930	Welcome remarks by the chairperson and introduction	Chairperson
0930 – 0945	Objective of the Workshop	Dr A. Mbwaga
0945 – 1000	Opening Speech	DC Kyela
1000 – 1030	Group photo and Tea Break	Participants
1030 – 1050	Problem of *Striga* on rice/maize production in Tanzania and control options	Dr A. Mbwaga
1050 – 1110	Achievement in the use of green manure technology to increase soil fertility and control of *Striga* for resource poor farmers	Dr G. Ley and Dr J Kayeke
1110 – 1130	Economics of growing green manure in rotation with cereals for resource poor farmers	Dr J. Hella
1130 – 1150	Factors that limited adoption of Marejea in mid 70's to mid 80's lesson learnt	Dr C. Riches
1150 – 1300	General Discussion of presented papers	All participants
1300 – 1400	Lunch break	All participants

Chairperson: ZRC Southern Highlands Zone **Raporteur: ZRELO Eastern Zone**		
1400 – 1420	Strategies of incorporation of *Striga* biology and control in school curriculum experience from Morogoro rural	DEO Morogoro
1420 – 1440	Strategies of incorporation of *Striga* biology and control in school curriculum experience from Kyela	DEO Kyela
1440 – 1500	District Strategies for dissemination of research results/products to reach wider audience	DALDO Kyela
1500 – 1520	District Strategies for dissemination of research results/products to reach wider audience	DALDO Morogoro
1520 – 1540	Strategies for communication of information from research to farmers and feedback: Experience of Central Zone	P Lameck
1540 – 1600	Group Formation	
1600 – 1620	Health break	All participants
1620 – 1700	Group Working	All participants

Day 3: : 21st June 2005 Chairperson ZRC Eastern Zone **Raporteur ZRELO Southern Highlands Zone**		
Time	**Activity**	**Responsibility**
0830 – 0850	Group Presentation	Group 1
0850 – 0910		Group 2
0910 – 0930		Group 3
0930 – 0950		Group 4
0950 – 1010		Group 5
1010 – 1040	Tea Break	All Participants
1040 – 1100	The role of Information Communication in technology development and promotion	J. Mika
1100 – 1020	The role of Media in information/technology /products dissemination and promotion	Sarah Dumba
1120 1300	Group convene for the way forward	
1300 – 1400	Lunch Break	All Participants
1400 – 1430	Workshop Recommendation	Facilitator
1430 – 1530	Closing words from Stakeholders Eastern Zone, Southern Highlands, Teachers, Kyela, Donor Representative, Workshop Organizers and Housee keeping issues	
1530 – 1600	Closing Remarks	DED Kyela

Day 4: 22nd June 2005 **Departure**		

Appendix: 2 Project Purpose:

A.M. Mbwaga, ARI Ilonga**, (Project Leader)**

<u>Project Purpose</u>:

This was: “Promotion of strategies to minimize impact of target pests in rice-based Land-Water interface cropping systems, for benefit of poor people”

The specific objective was

participatory evaluation and promotion of legumes (the green manure *Crotalaria ochrelucra* or pigeon pea) in rotation with rice for control of *Striga* to improve rice productivity on *Striga* infested soils.

<u>Output 1</u> Participatory evaluation and promotion of green manures (Marejea and Pigeon pea) used in rotation with rice on Striga infested soils:

Through a series of seminars farmer research groups were formed in eight villages in Kyela where rice is the major food and cash crop and five in Matombo Morogoro rural districts, where both rice and maize yields have declined due low soil fertility and *Striga* infestation

<u>Output 2:</u> Identification, preparation and publication of information sources to support promotion of green manure in rice based farming system

A total of 21 village primary schools participated in the project

Aim

Introduce knowledge on biology and *Striga* management in the agricultural school science curriculum.

Schools demonstrated the value of *Crotalaria* and pigeon pea to increase soil fertility and control of *Striga* through

songs, plays, poems, traditional dances and setting demonstration plots at their schools farms

Leaflets and posters on the use of *Crotalaria* have been produced and are being used by extension staff, farmers, and schools

Appendix 3: Project activities

1. Farmer exchange visits and field days

1.1 Summary of farmer exchange visits 2003-2004

	Village		Number of visitors	
Date	**Visitors from:**	**Village visited:**	**Farmers**	**Extension**
22 May 2003	**Kiswira & Kibangile**	**Kilasilo**	**29**	**4**
23 May 2003	**“**	**Itope**	**29**	**4**
24 May 2003	**Sinyanga, Konjula**	**Kilasilo & Itope**	**17**	**2**
27 May 2004	**Kilasilo & Itope**	**Kiswira**	**10**	**8**
28 May 2004	**Kilasilo & Itope**	**Kibangile**	**10**	**8**

1.2 Summary of field days held 2003-2004

Date	***Village field day held***	***Farmers***	***Extension***
14 June 2003	***Kilasilo***	***35***	***5***
19 May 2004	***Kiswira***	***36***	***4***
20 May 2004	***Kibangile***	***80***	***4***
14 June 2004	***Kilasilo***	***35***	***9***

2.0 Promotion through primary schools

2.1 Kyela primary schools involved with the project and their activities 2003-2004.

Activity	Lema	Kandete	Ngamanga	Nduka	Nkuyu	Lema[2]	kisale	Mbogela	Lugombo	Lukwego	Kyela	KCM	Lusungo	Kasumulu	Mbula
Choir								√						√	√
Poems	√			√	√	√	√			√		√			
Drama				√											
Traditional dance		√									√		√		
Demo plots	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√

2.2 Matombo Primary schools involved with the project and their activities 2003-2004

	Kibangile	Konde	Mlono	Matombo	Mkumbo	Gozo
Choir	√	-	-	√	√	-
Poems	√	√	√	√	√	√
Drama	√	√	-	-	-	-
Tradional Dance	√	-	√	-	-	-
Demo plots	√	√	√	√	√	√

Appendix 4: Objectives of the Workshop

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- ►Rational of the project
- ►Present results achieved through the project
- ►Develop the way forward

Appendix 5: LIST OF PARTICIPANS

Name	Professional/Kazi	Address/Anwani	E-mail/Mobile phone
A.m. Mbwaga	Researcher	ARI-Ilonga , Private Bag Kilosa	ambwaga@yahoo.co.uk
G. Ley	Researcher	ARI-Mlingano S.L.P.5088, Tanga	0744295276 gley2@yahoo.com
Charles R. Riches	Agronomist	Natural Resource Institute UK	charlie@riches27.freeserve.co.uk
Juma Kayeke	Researcher	ARI-Uyole S.L.P 400 Mbeya	0744488112 jkayeke@yahoo.com
Herriel Kisumo	Extension-Matombo	S.L.P. 747 Morogoro	0744821476
Filbert Roman	Farmer Kibangile village Morogoro	S.L.P. 1880 Morogoro	0232605632
Samson N. Mwangimba	DALDO Office Chunya	S.L.P. 107 Chunya	
Lebai T.H. Nsemwa	Researcher	ARI-Uyole S.L.P. 400 Mbeya	0744895994 nsemwalth@yahoo.co.uk
F.A.Myaka	Researcher	ARI-Ilonga, Private Bag Kilosa	fmyaka@yahoo.com 2rc@iwayasuze.com
O.M. Ishumi	Extension	S.L.P. 33 Kilosa	Onesishumi@yahoo.com 0748378988
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Patric Mwalukisa	Agronomist	IRDTF Box 160 Ileje	pmwalukisa@yahoo.com
Sosthenes Ruheza	Agric. Officer	CARE International Box 289 Morogoro	0744862010 ruheza@yahoo.com
Adam Siwinga	Agronomist	ADP Mbozi TF Box	
J.A. Kamasho	Researcher	ARI-Uyole Box 400, Mbeya	0744829809
P.B.Mbwaga	Researcher	ARI-Uyole Box 400, Mbeya	pbmbwaga@yahoo.com
D.S. Kamwela	DALDO Ileje	Box 52 Ileje	0744-829947, 0748-714263 dkamwela@yahoo.com
S.U.Njetile	Farmer-Sinyanga village	Box 33 Kyela	0744-8736363
R.M.Mwailubi	Farmer-Konjula village	Box 5454 Kyela	0748-370988
Abraham, B	DALDO Kyela	Box 188 Kyela	0744-880482, abrahambernad@yahoo.co.uk
G.T. Mangwale	DEO Kyela	Box72 Kyela	0744-635945
V.E. Mbena	DEO Office Kyela	Box 72 Kyela	0748-380640
E.M. Payo	Teacher Mbako primary school	Box 274 Kyela	0744- 954204
A.F. Mwaseba	Farmer Kilasilo village	Box 231 Kyela	0744-203727
W.K.Mwaipasi	DEO Office Kyela	Box 72 Kyela	0744- 345284
Cornel Massawe	Researcher	Box 133 Kilosa	masawesa@yahoo.com 023-2623201
Ali S. Mwegole	DEO Morogoro	Box 610 Morogoro	0748-816385, 0746-437448
Emilian E. Kishinda	DEO Office Morogoro	Box 610 Morogoro	0745-752854
Job D. Mika	Information Officer Central Zone	Box 73 Dodoma	0741/0748-213500

Remtula Naftali Deoduths	DEO Kilosa Farmer Kiswira Mororgoro	Box 164 Kilosa	0748-797339
Joseph n.Mwaulesi	Ag DALDO Mbozi	Box 94 Mbozi	025-280085
Evelyne Masangya	DALDO Office Mororgoro	Box 747 Morogoro	0744-026770
Imelda Ishuza	DALDO Office Morogoro	Box 747 Morogoro	0744-826188
Hussein Lugazo	DEOs Office Morogoro	Box 610 Mororgoro	0748-442767
Michael Mwampaja	DALDO Office Kyela	Box 188 Kyela	0744-930117
Joseph P Hella	Researcher SUA	Box 3007 Morogoro	0748-582110
Henry Mwangosi	DALDO Office Kyela	Box 188 Kyela	0748-236410