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Korean Government - SAFGRAD Funded on-Farm Demonstration *Striga* Control Technologies

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List of institutions participating in the Korean Government/SAFGRAD funded on-farm demonstration of *Striga* control technologies

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Cote d'Ivoire	Centre National de Recherche Agronomique, Abidjan	Dr. Louise Akanvou
Ghana	Savanna Agricultural research Institute Nyankpala, Tamale, Ghana	Dr. M. Abdulai
Mali	Centre Régional de Recherche Agronomique de Sotuba Institut D'Economie Rurale Ministère de l'Agriculture de l'Elevage et de la Pêche, République du Mali	Dr. N. Coulibaly
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Executive Summary

In sub-sahara Africa drought and *Striga Hermonthica* constitute serious threat to food security and poverty alleviation. The 2004 cropping season was characterized by severe drought occurring specially in Mali, Burkina Faso and in Sudan Savanna of Nigeria and Cameroon. In addition to this, *Striga Hermonthica* incidence was higher in those area than in 2003. These two constraints resulted in dramatic grain yield reduction at the farmer level i.e maize variety trial demonstration yielded in Sudan Savanna of Nigeria 460 kg ha^{-1} and 352 kg ha^{-1} with STR maize and farmers' maize, respectively. Grain yield of less than 1000 kg/ha were also recorded in Mali during the same period.

The collaborative *Striga* research and control project aims at sustaining food security and poverty alleviation in Africa. This project funded by the Republic of Korea through Kyungpook National University and by the African Union through SAFGRAD, have permitted the development, the evaluation and the promotion of appropriate *Striga* control technologies and have ensured effective transfer of these technologies to farmers. Therefore, from 2002 to 2004, more than 5180 farmers were reached by NARS of participating countries. 3734 farmers were involved in technologies evaluation and demonstration, and 1446 participated since 2003 in technologies dissemination. Grain yield increase due to STR technologies have been reported to be more than 40% where *Striga* incidence was important and around 15% in those areas or years when *Striga* incidence was negligible. This findings suggested that: advantage of using the STR technologies is still evident on *Striga* free land.

During the 2004 season, 6 out of seven participating countries conducted the collaborative *Striga* research and control activities as observed during the monitoring tour. Political situation in Côte d'Ivoire could not permit the implementation of project activities in this country. Except for Ghana, activities reports were obtained from 5 countries. This report showed that 1980 farmers participated in the project activities. This was already more than in 2003, not including Ghana farmers. Technologies diffusion, started in 2003, revealed that 1221 farmers in 17 new villages were exposed to STR maize and legume varieties through seed distribution. 67% of these new participating farmer indicated that the new technology was better and yielded higher than their usual practises. However, only 20% of them confirmed the good capability of the technologies in reducing the number of *Striga* plants emerged. This was probably, those farmer which had low *Striga* incidence in their field. Farmers field days organisation which was compulsory to all participating NARS, was reported by 3 countries. A total of 450 farmers participated in four villages to this activity. For the first time since the inception of the project, none of the country will need STR maize and legume seed in 2005, indicating that, participating NARS, have been able to strengthen their capacity to produce STR maize variety and legume seed. In 2004, more than 11413 kg of maize seed and 2005 kg of legume were reported through the on-farm community seed scheme, recommended in 2002 by the *Striga* Task Force (STF) during the review and planning workshop.

The 2004 project activities were evaluated during the scientific monitoring tours that took place in October 2004, and covered Benin, Burkina Faso, Cameroon, Mali, Ghana and Nigeria.

The 16 mm video tape produced in 2003 were broadcasted in some participating NARS television i.e Mali, Burkina Faso. This video illustrated that substantial progress could be realized towards sustainable food security and poverty alleviation through *Striga* control in sub-Sahara Africa.

Technology demonstration involved 187 farmers in 60 villages. On farm variety demonstration were pursued by 102 farmers and covered 24 villages. New STR maize with extra-early maturity cycle were reported in Sudan Sahelien zone of Nigeria. The on farm variety demonstration yielded on average 25% more than the farmers' maize. Sole STR maize exhibited 60% reduction in *Striga* seed bank as compared to farmer technologies.

Lower grain yield superiority of the STR maize over the local was partly attributed to the severe terminal drought encountered in 2004. Maize grain yield obtained through cropping systems suggested by this project to control *Striga* (rotation and intercropping maize legume) were in 2004, better than grain yield obtained with sole STR maize. On farm intercropping demonstration yielded an average of 29% grain yield superiority of the STR maize over the farmers' practices.

For 2005, more STR maize and legume seed are available in participating NARS. This will encourage the scaling up of the diffusion of the project recommended technologies. Therefore it is anticipated that a larger number of villages and farmers will be exposed to STR maize and legume varieties through seed distribution.

The achievement and impact of the project could be better observed with increase funding and the conduction of an impact assessment and an external evaluation.

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Introduction

Maize is an important component of food security and poverty alleviation. It plays a prominent role in the socio-economic life of people of the sub-Sahara Africa region. The popularity of the crop derives from its ease of cultivation, high response to inputs and the high level of diversification of its uses. Even though maize is cultivated in all sub Sahara countries, the continent imports about 12 million tons of maize grain annually, specially for brewery and feed industries. Maize production is hampered by a parasitic weed, *Striga spp,* which causes grain yield loss between 30 and 60%. It is estimated that the livelihood of more than 500 millions people is affected by this parasitic weed.

Considerable efforts by International Agricultural Research Centers (IARCs), Regional research centers and National Agricultural Research Systems (NARS) have been devoted to solving the *Striga* problem in Africa. Since 1999, consistent progress in *Striga* research and control has been achieved by countries participating in the Africa *Striga* Collaborative Research and Control project, funded by the Republic of Korea and the African Union. Aiming at enhancing complementarity and synergy for an effective *Striga* control, the project is implemented through partnership with participating NARS, farmers, extension agencies, International Agricultural Research Institute (IARCs) IARI (South Korea), IITA, WECAMAN and SAFGRAD. The annual review and planning workshop has generated realistic project activity workplan and appropriate strategies for their implementation. Therefore, through technologies evaluation and demonstration, participating NARS have identified appropriate STR maize and legume crop for their respective country. Increasingly, NARS scientists use germplasms introduced from IARCs to develop cultivars more adapted to their respective agro-ecological zones and to their farmer preferences. However, in sub-Sahara Africa, drought is also a serious constraint to food security. It is therefore expected that germplasms combining drought and *Striga* tolerance will lead to more sustainable production of maize for the sub-region. Thus, the reported 40% grain yield superiority obtained in this project for the improved technology over the farmers' practises could be improved.

STR maize and legume crop already available in participating NARS through community seed production recommended in 2002, will allow the involvement of a larger number of farmers through the rapid diffusion of seed. In 2002, 1257 farmers were reached by the project. This number increased in 2003 by 55% and reached 1943 farmers. In 2004, data obtained so far, indicated that more farmers were attracted by project activities.

Scientific monitoring tour and survey conducted have permitted to evaluate project activities and to assess farmers' perception of technologies demonstrated. Achievements were documented in 2003, by the production of a 16 mm video tape already broadcasted in some countries. The aim of this report is to document the progress made by participating countries in 2004 towards attainment of the project objectives which are the realisation of food security and poverty alleviation through improvement of maize based farming systems.

2004 activities and main achievements

Activities planned for 2004 included the following:

- Review and planning workshop
- On farm implementation of *Striga* control measures
- Training of farmers
- Field days organisation
- Farmers' perception of the technology assessment
- Scientific monitoring tours

2.1. Review and planning workshop

The 2004 review and planning workshop was held at Ouagadougou between 3-4 June 2004. Participants from six countries attended this meeting which signalled the end of the 2003 project activities and the commencement of activities for 2004. Countries represented included: Benin, Burkina Faso, Cameroon, Côte d'Ivoire, Ghana, Mali and Nigeria. The list of participants at this review and planning workshop is presented in Appendix 1.

The main objectives of the workshop were: i) to evaluate project activities achieved by participating countries during the 2003 cropping season; ii) to appreciate various constraints in executing the 2003 planned activities and map workplan and design strategies for successful implementation of the project in 2004.

During the workshop, a 16 minutes videotape of project activities in some participating countries was presented. This video highlighted project strategies and achievements to date towards sustainable food security and poverty alleviation through *Striga* control in sub-Saharan Africa. This video was broadcasted in some partici-

pating countries viz Mali, Burkina Faso. During the workshop collaborating scientists made presentation of their activities during 2003 and made suggestions on planned activities for 2004. A review on progress made in Striga research in maize including use of biotechnology was also highligted. From the workshop deliberations, it was noted a substantial increase in the number of farmers who had access to integrated technologies for *Striga* management. In addition, except for one country, all participating NARS improved their capacity to produce STR maize seed and appropriate cowpea variety. Planning of 2004 activities took into account, the 2003 shortcomings in order to maximize success. The suggested 2004 workplan is presented in **table 1**

As it could be observed from table 1, the 2003 delayed in workplan implementation, resulted in late funds disbursement in 2004. However, observations made during the monitoring tour revealed that on-farm activities were carried out successfully by all participating countries.

The 2004 review and planning workshop participants agreed on the following:

- The need to continue to keep demonstration simple and extensive as to cover greater number of farmer.
- The need to organize field days in order to achieve maximum impact.
- The need for participating countries to enter into the diffusion stage when sufficient confidence of the demonstration has been generated.
- The need to assess farmers' perception and acceptance of the project *Striga* management technologies and strategies.
- The need to encourage community seed production in order to increase the availability of STR maize and leguminous trap crop seed.

The following recommendations were made:

- There is a need to properly choose the STR-maize, whose maturity cycle fit the rainfall regime.
- Trial management should be improved by collaborating with the near by extension agent.

Table 1. **2004 Project Workplan**

Activities	Period	Observations on implementation
1. Finalization of country level activities.	June 15, 2004	As scheduled
2. Funds disbursement	ASAP	Timely done
3. Writing script for videotape production.	June 30, 2004	None
4. Implementation of country project proposal.	April to December 2004	Done
5. Monitoring tour	September 2004	Delayed to October 2005
6. Videotape production at country level.	December 2004	None
7. Submission of country annual report .	February 2005	Delayed to April 2005
8. Submission of country financial justifications.	March 2005	Late for some countries
9. Project 2004 annual report	End March 2005	May 2005
10. Project review and planning workshop.	April 2005	Not yet

- Scaling up of activities should be pursued and the diffusion phase should be implemented by all countries.

- Community based seed production should be done in synergy with existing in country community seed programs. The contribution of the breeder should be compulsory.

- Documentation of country achievement should be done and provision should be made for external evaluation as well as impact assessment.

2.2. On farm demonstration of Striga control technologies

The 2004 project activities and the number of villages and farmers reached in participating countries are presented in **table 2**.

In 2004, except for Ghana, five participating countries worked with 1980 farmers which represented already 2% increase over 2003 and 58% increased over 2002. It should be noted that technology diffusion was emphasized on in 2004 with 1221 farmers involved in this activity alone. New villages and agro-ecological zones where *Striga hermonthica* is a threat to maize production were covered as recommended by the review and planning workshop.

The late disbursements of the funds and the early and late drought spells experienced by many countries in 2004, limited the number of villages covered in order to demonstrate, the on farm rotation and intercropping of maize/leguminous crop. In 2004, community seed production was done in all participating countries and more STR maize seed and leguminous trap crops are available for the 2005 season.

Three countries out of the six, conducted survey in 2004 to assess farmers' perception of the technologies evaluated.This survey demonstrated an increased impact of the project towards sustainable food security and poverty alleviation at the farmer level. In general, the technologies demonstrated showed 13% to 57% grain yield increased over farmers' practises. This was indicated by 66.7% of participating farmers who expect

Table 2. **Activities, number of villages and farmers reached in participating countries, 2004**

ACTIVITIES	PARTICIPATION COUNTRIES											
	Benin		Burkina Faso		Cameroon		Mali		Nigeria		TOTAL	
	N° of village	N° of farmers	N° of village	N° of farmers	N° of village	N° of farmers	N° of village	N° of farmers	N° of village	N° of farmers	N° of village	N° of farmers
DEMONSTRATIONS												
On farm variety demonstration	*		8	26	5	21	5	12	6	50	24	102
On farm rotation demonstration	*	*	1	8	3	11	3	12	2	6	9	37
On farm intercropping	2	15	1	8	4	13	3	12	-	-	10	48
On Farm technology diffusion	3	21	-	-	8	540	-	-	6	660	17	1221
Sub-total	5	36	10	42	20	585	11	36	14	716	60	1415
OTHERS												
▪ Seed Production	X	X	*	*	4	9	2	18	2	4	8	31
- community level	X	X	1	*	1	-	*	*	*	*	2	-
- on station	*	*	*	*	1	150	1	200	2	100	4	450
▪ Field Days	-	-	*	*	1	12	2	18**	1	72	4	102
▪ Training/meeting	*	*	1	26	8	540	-	-	2	675	4	1241*
▪ Survey**												
Total number reached in 2004		36		42		756		254		892		1980
Total number reached in 2003		622		23		651		25		557		1943
Total number reached in 2002		87		-		721		26		173		1257

* data not available
** not included in total number

Table 3. **STR Maize and legumes cultivars demonstrated for Striga for control in 2004**

COUNTRIES	STR-MAIZE CULTIVARS		LEGUMINOUS CROPS		
	Names	Genetic Background	Cowpea	Soybean	Groundnut
BENIN	ACROSS 97TZL COMP-1-W	Composite	TVX1850-01F	-	-
	ACROSS 94TZE COMP-5-W				
	ACROSS 92TZE COMP-5-W				
BURKINA FASO	ACROSS 94TZE COMP-5-W	Composite	KVX 61-1	-	-
	SR 21	"			
	SR 22	"			
	OBATAMPA	"			
	ESPOIR	"			
CAMEROON	ADVANCED NCRE STR	Synthetic	TVX 1850-01 F	-	-
	CAM INB STR1	"	KVX 61-1		
	STR-Y	"	Lori I		
	49351	"			
	CMS 8501	"			
MALI	ACROSS 94 TZL-W	Composite	TVX 1850-01 F	-	-
	EVDT 97 STRC1	"			
	DEMBANYUMA	"			
NIGERIA	ACROSS 97 COMP 1-W	Composite	IT 93K 452-1	TGX-1448-2E	RMP91
	TZEE-Y STR	"			
	EVDT-W 99 STR CO	"			
	ACROSS 94 COMP-5-W	"			
	SYN 2000 EE-W	Synthetic			
GHANA	ACROSS 94 TZE COMP-5-W	Composite	-	*	-
	ACROSS 97 TZL COMP-1-W	"			
	IWD STR C1	"			
	OBATAMPA	"			

* Variety name not ascertained

their farm income to be increased by 13% to 57% by adopting technologies demonstrated by this project.

In 2004, 16 differents STR maize cultivars were used for project activities **(table 3)**. These included new maize with different maturity cycle (from extra-early to intermediate), different texture and color, to suit agro ecologic situations and farmers' preference. The on-farm demonstrations also rely on 4 cowpea, 1 soybean and 1 groundnut cultivars. Exchange of germplasm between participating NARS was evidenced by the sharing of cowpea TVX1850-01F and KVX 61-1 by four countries. Except for seven STR-maize developed by NARS, genetic materiels used originated from IITA and WECAMAN.

2.2.1. On farm variety demonstration

This activity was conducted by 4 participating countries in 24 villages. The summary of the results obtained for the 102 trials is presented in **table 4**. This activity compared STR maize with variety used by the farmer. Each variety was planted on 20m x 20m plot infested by *Striga hermonthica* in 2003. Result indicated that, STR maize generally outyielded the farmers' maize by 25%. Grain yield superiority ranged from 8% obtained in Mali under severe drought to 43% obtained in the Sudan Savanna of Cameroon. All participating countries experienced terminal drought which were very severe in Mali, Burkina Faso and the Sudan Savanna of Nigeria. *Striga* incidence was intermediate to


Harvest of maize crop

high, ranging from 3488 to 18415 *Striga* plants emerged per hectare with the *Striga* sensitive cultivar. STR maize exhibited on average 3551 *Striga* plants emerged per hectare as compared to 8936 *Striga* plants ha^{-1} obtained with the farmer maize. This represented 60% less *Striga* plant emerged on STR maize plot. In Nigeria, STR maize also demonstrated 50% less damage on maize leaves. The 25% grain superiority of the STR maize was partially explained by its ability to sustain under *Striga* infestation, higher plant density at harvest (4%) and higher ear number with maize grain (9%).

Table 4. **PROJECT RESULTS SUMMARY : On Farm variety demonstration, 2004**

PARAMETERS MEASURED	TECHNOLOGY DEMONSTRATED	PARTICIPATING COUNTRY						MEANS
		Burkina Faso	Cameroon Sudan S.	Cameroon Guinea S.	Mali	Nigeria Moist savanna	Nigeria Guinea + Sudan	
Maize grain yield (kg/ha)	- STR maize means	1116	2333	2888	945	2531	460	1712
	- farmers maize	896	1632	2617	879	1861	352	1373
	% farmer	125	143	110	108	136	131	125
Number of Striga Plants emerged ha^{-1}	- STR maize	2367	*	9050	4225	1772	339	3551
	- farmers maize	18415	*	13902	4400	4167	3788	8936
	% farmer	13	*	65	96	43	9	40
Maize plant stand at harvest (number/ha)	- STR maize means	34679	40938	39688	41094	49934	34213	40091
	- farmers maize	34880	36562	30781	50703	49566	28388	38480
	% farmer	99	112	129	81	101	121	104
Maize cobs at harvest number/ha	- STR maize means	*	36563	37188	23672	42736	14538	30939
	- farmers maize	*	35562	28438	27422	41004	9253	28336
	% farmer		103	131	83	104	157	109
Maize Striga damage score (1-9)	- STR maize means	*	*	*	*	3.4	1.7	2.6
	- farmers maize	*	*	*	*	5.0	5.3	5.2
	% farmer					68	32	50

* data not provided

2.2.2. On Farm rotation demonstration

This activity involved 37 farmers in 9 villages, including farmers having 3 years of rotation on the same plot. The drastic reduction of participating farmers (from 102 in 2003 to 37 in 2004), could be partially explained by the fact that we could not obtained Ghana annual report where most farmers used rotation of maize and leguminous crop, specially soybean. The results summary obtained in 4 participating countries are showed on **table 5**. In spite of the severe drought experienced, STR maize outyielded the farmers' maize by 13%. Grain yield superiority of STR maize ranged from 8% obtained in Cameroon Guinea Savanna and in Mali to 25% obtained in Burkina Faso. With rotation STR maize exhibited 55% less *Striga* plant emerged than the farmers' technology. *Striga* incidence was intermediate to high. The farmer maize showed *Striga* infestation ranging from 3225 *Striga* plant ha^{-1} in Guinea Savanna of Nigeria to 45.000 *Striga* plant per hectare in Burkina Faso. *Striga* severity on STR maize plant was 73% less than on the local practises. The 13% grain yield superiority obtained was attributed to 65% less *Striga* plant emerged, 24% more maize plants at harvest, 19% more maize ear at harvest and to the 73% less *Striga* damage on STR maize leaves as compared to farmers' maize. Leguminous (cowpea) grain yield of 457 kg ha^{-1} was reported by Burkina Faso who was on its 2nd year of rotation.

Table 5. **Project results summary : ON FARM ROTATION DEMONSTRATION, 2004**

PARAMETERS MEASURED	TECHNOLOGY DEMONSTRATED	PARTICIPATING COUNTRY					MEANS
		Burkina Faso	Cameroon Sudan S.	Cameroon Guinea S.	Nigeria Guinea + Sudan	Mali	
Maize grain yield (kg/ha)	- STR maize means	956	1836	2831	798	342	1353
	- farmers maize	763	1632	2617	675	316	1201
	% farmer	125	113	108	118	108	113
Number of Striga Plants emerged ha^{-1}	- STR maize	19900	-	7850	94	8516	9090
	- farmers maize	45000	-	13900	3225	17656	19945
	% farmer	44		57	3	48	45
Maize plant stand at harvest (number/ha^{-1})	- STR maize	*	40156	40313	289525	44844	38566
	- farmers maize	*	36563	30781	21038	36094	31119
	% farmer		110	131	138	124	124
Maize cobs at harvest number/ha	- STR maize	*	36625	36563	23188	19766	28786
	- farmers maize	*	35625	28438	17863	15000	24332
	% farmer		100	129	130	132	119
Legume yield (kg.ha^{-1})	Sole legume	457	*	*	*	*	*
Crop damage score (1-9)	- STR maize means	*	*	*	1.5	*	1.5
	- farmers maize	*	*	*	5.5	*	5.5
	% farmer				27	*	27

* data not provided

Large scale rotation maize/groundnut, Burkina Faso

2.2.3. On Farm intercropping maize-legume demonstration

This on farm activities was carried out by 48 farmers in 10 villages of 4 participating countries. The project results summary is presented in **table 6**. Results obtained by farmer after 3 years of continuous maize legume intercropped revealed 29% grain yield superiority of the STR maize over the Farmers' maize. 57% grain yield superiority was reported in Benin for 6 farmers who were at their second year of continous intercropping. After 3 years of continuous intercropping, average grain yield of the STR maize was 2083 kg ha^{-1}, ranging from 505 kg ha^{-1} in Mali to 3973 kg ha^{-1}, obtained in Benin. *Striga* incidence was very high in Burkina Faso and Benin which experienced more than 21000 *Striga* plants emerged per hectare. In general, STR maize supported 38% less *Striga* plant emerged as compared to farmer maize.

Taditional cereal/cowpea intercropping in Burkina Faso

Table 6. **Project results summary : ON FARM MAIZE/LEGUME INTERCROPPING, 2004**

PARAMETERS MEASURED	TECHNOLOGY DEMONSTRATED	PARTICIPATING COUNTRY					MEANS
		Benin	Cameroon Sudan S.	Cameroon Guinea S.	Mali	Burkina Faso	
Maize grain yield after 2 continuous Maize/legume	- STR maize	4112	-	-	-	-	4112
	- farmers maize	2625	-	-	-	-	2625
	% farmer	157					157
Maize grain yield after 3 continuous Maize/legume	- STR maize	3973	2218	2743	505	975	2083
	- farmers maize	2972	1632	2617	108	763	1618
	% farmer	133	136	105	467	128	129
Striga plants emerged after 2 continuous Maize/legume	- STR maize	73000	-	-	-	-	7300
	- farmers maize	73000	-	-	-	-	7300
	% farmer	100					100
Striga plants emerged after 3 continuous Maize/legume	- STR maize	37000	*	7813	4063	21000	17469
	- farmers maize	37000	*	13909	17563	45000	28368
	% farmer	100		56	23	47	62
Number of plant at harvest	- STR maize	-	38594	36250	43438	*	39427
	- farmers maize	-	36563	30781	36094	*	34479
	% farmer		106	118	121		114
Number of cobs at harvest	- STR maize	-	34531	35469	35469	*	35156
	- farmers maize	-	35625	28438	30625	*	31562
	% farmer		97	125	116		111
Legume crop yield	- IN STR maize	450	*	*	*	*	450
	- IN farmers maize	450	*	*	*	*	450
	% farmer	100					100

2.2.4. On Farm technologie diffusion

This activity was highly recommended to participating countries which had sufficient confidence on the technology demonstrated. Activity consisted of providing many farmers with either STR maize seed and/or leguminous *Striga* trap crop. The farmer was advised to grow his/her maize along side STR maize on fields previously infested by *Striga hermonthica*. He was also told to grow cowpea and maize in the same field or in different field, providing that the sole cowpea field will be used in 2005 for maize cultivation. During the 2004 cropping season, 1221 farmers from 17 villages conducted this trials. In Cameroon and Nigeria, a questionnaire was administered to participating farmers to assess their perception of the technologies being disseminated.

2.2.5. On Farm Community based seed production

This activity was recommended to all participating countries during the review and planning meeting of 2002 and 2003. The community based seed production would serve to enhance community participation in the project, besides empowering farmers involved through production, processing and sales of their seeds. The project results summary on seed production during the 2004 season is presented in **table 7.** All participating countries produced enough seed for the 2005 project activities. The Foundation seed production on research station, gave 2460 kg of STR maize seed and 175 kg of leguminous crop seed. The community based seed production scheme gave 11413 kg of STR maize seed and 2005 kg of legume seed. Seed quantity produced in 2004, represented an increase of 187% over STR maize community seed produced in 2003.

Table 7. **PROJECT RESULTS SUMMARY: STR maize and cowpea seed production, 2004**

COUNTRY	CROPS	VARIETY	SEED QUANTITY	
			On station	Community level kg
BENIN	Maize	Across 94TZE comp-5-w	-	850
	Cowpea	TVX 1850-01 F	-	650
CAMEROON	Maize	Advanced NCRE	100	4200
		Cam Inb Str	80	1350
		STR-y	50	1750
		49351	30	-
	Cowpea	TVX 1850-01 F	100	-
		Lori	50	-
		KVX 61-1	25	-
NIGERIA	Maize	Across 94 TZE comp-5-w	-	263
		Across 97 TZL comp-1-w	-	1100
BURKINA FASO	Cowpea	IT 93K452-1	-	1355
	Maize	Across 94 TZE comp-5-w	*	*
		- SR 22	*	*
		- Espoir	*	*
	Cowpea	KVX 61-1	*	*
MALI	Maize	Across 94 TZL-w	*	1000
		Dembanyuma	*	900
TOTAL	Maize	-	260	11413
	Legume	-	175	2005

2.2.6. Farmers' perception of the project technologies

Parameters were determined by administration of a questionnaire to participating farmers involved in the diffusion. In 2004, 3 participating countries conducted a survey to assess the farmers' perception of the project activities. The survey sampled 1221 farmers in 17 villages. The project summary on 2 parameters measured is showed on **table 8**. Only 20% of the farmer indicated that STR-maize demonstrated were good and very good in reducing *Striga* incidence on maize. 51% of the farmer rated STR maize fair while 29% did not think that the technology could cut down on number of *Striga* plants emerged. However, 67% of the farmer indicated that STR maize yielded better than their local maize and only 10% preferred their local maize to STR cultivar. It was noted during the survey that STR maize rated high in those areas where *Striga* incidence was high and poorly in those area where farmer used fertilizer, with minor *Striga* incidence.

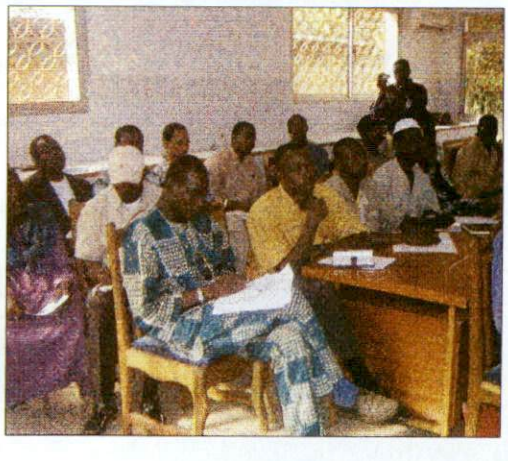
Table 8. **PROJECT RESULTS SUMMARY: Farmers'perception of STR-maize, 2004**

PARAMETERS	PARTICIPATING COUNTRY (%)			MEANS (%)
	CAMEROON	NIGERIA	BURKINA FASO	
STR-Maize Striga reduction ability				
▪ Very good	10	0	-	5
▪ Good	25	5	-	15
▪ Fair	27	75	-	51
▪ Poor	38	20	-	29
STR-Maize yield				
▪ Less than local (poor)	6.9	12.5	10	9.8
▪ Same as local (fair)	10.4	60	0	23.5
▪ Better than local (good + very good)	82.6	27.5	90	66.7

Farmers grading maize cobb in Burkina Faso during a field day

2.2.7. Training

Training of extension agents and farmers involved in community seed production was reported by 3 participating countries. This training involved 102 persons and was conducted in 4 villages. The ultimate objective was to teach farmers and extension agents on seed multiplication techniques viz, field isolation, removal of off-type and diseased plants, seed handling, seed storage and marketing. In addi-



Training of farmers, Burkina Faso

tion farmers also learned how and when to weed, to apply fertilizer and to harvest their maize.

2.3. Scientific Monitoring tour

A scientific monotoring tour was conducted between october 22, 2004 and november 7, 2004. All 6 participating countries were visited viz Mali (22-24 october), Burkina Faso (25-28 october), Ghana (29-30 october), Cameroon (3-7 november), Nigeria (2-4 november) and Benin (4-7 november). The objective was to assess at first hand, country activities implementation and to interact with all stakeholder, especially farmers.

In Mali, Dr Charles THE visited 4 variety trial in kolokani zone and seed multiplication in Bougouni area. Variety trial consisted in comparing 1 STR-maize (Across 97 TZL comp1-w and IWDT C1) with 2 local maize, Dembanyuma. In Bougouni area, the rotation trials were already harvested but 2 community based seed production farms were appreciated. Except for Bougouni zones, trials visited were severely hit by terminal drought. In addition, STR-maize demonstrated in kolokani district were inadequate because they were of immediate maturing cycle (110-115 days) for an area with 750 mm as average rainfall. In addition, trials were implemented late.

In Burkina Faso, 4 intercropping/rotation trials were visited by Dr Charles THE and Dr Louise AKANVOU. In Fada district situated in Soudan savanna zone of Burkina Faso, 2 of the trials were good but the 2 others were poorly managed by the participating farmers. Grain yield expected from Fada trial should be very low due partly to drought and to low plant density observed. Striga infestation was low in this area. In Bobo-Dioulasso zone, 6 villages were visited. 6 on farm variety trials as well as 2 community based seed production were visited. Variety trials compared Across 94 TZE comp5, to cultivars already released ie SR21, SR22 and espoir. Trials were very well managed and Striga infestation was fair. Farmers indicated that Accross 94TZE comp5, performed better and that they would like seed for the 2005 season. Seed multiplication of Mr Milogo was a response to this need.

Farmers exchanging views with scientists in Burkina Faso during monitoring tour

It was recommended for Burkina Faso, that variety demonstration as well as rotation/intercropping demonstration should be conducted in Both Soudan Savanna and Northern Guinea savanna. Thus the 2 teams encountered should worked together in all striga endemic zones.

In Nigeria, Dr Sam Ajala and Dr Mahama Ouedraogo visited demonstrations from 2-4 november 2004 in the Soudan Savanna. Trials in Southern and Northern guinea savanna were already harvested. In Tashan Sole village, a total of 14 demonstrations trials were planned. Varietal demonstration used early and extra-early STR maize cultivars. Rotation trials involved soybean and Across 97 TZL-comp1W. Contiguous trials were again noted in this area. However, trials were in general well managed. Two community based seed multiplication of STR-maize conducted on 0.3 ha each, was expected to produce enough seed for the 2005 diffusion. Soybean variety TGx 1448-2E was largely grown for rotation purpose.

The Research team indicated that soybean farmers were linked to an oil company for the purchase of soybean grain at harvest.

Cameroon was visited by Dr S.T.O Lagoke from 3-7 november 2004. Various on-farm activities were visited in more than 5 villages. In Badenkalli village, farmers was participating for the first time in project activities, 3 STR-maize community based production were appreciated. Cultivars consisted of Cam Inb STR and advanced NCRE. Both field were planted or 0.3ha and were very well isolated. 3 Maize/cowpea intercropped field were also visited. Two of these fields were poorly managed and was expected to yield poorly. The two farmers involved in on-farm diffusion of the technologies indicated that they could not purchased fertilizer and that their farm was also hit by drought.

In Gatougel, the team participated in a field day attended by more than 150 farmers. During the field days, farmer involved in diffusion of technologies, presented 2 on-farm community based seed multiplication and 4 farms involved on variety diffusion. Cultivars concerned were: advanced NCRE STR and Cam Inb STR. The monitoring tour in Cameroon ended by the visit of on station trials and breeder seed maintenance.

In Benin, the team made of Dr SAM Ajala and Dr Mahama visited in Natitingou zone, trials conducted in collaboration with CARDER, the extension agency. The CARDER director Mr Seidi Sahabi, indicated that striga was a big problem in this district and that its organisation is multiplying in 6 vilages, the STR-maize, Across TZL-comp1-w on 33 ha for use in 2005. In Benin, rotation as well as intercropping demonstration were also seen in Ourou and Kobly. Farmers indicated that they would like to evaluate STR-maize after cotton residues incorporation.

Finally in Ghana visited by Dr Charles THE and Dr Louise Akanvou from 29 - 30 october 2004. The team leaders could not be met and the team visited only 2 on station seed multiplication.

Farmers and scientists interacting during a field visit

Country Achievements

BURKINA FASO

In Burkina Faso, two types of trials were implemented in 2004: on-farm demonstration trials of STR maize varieties (around Bobo-Dioulasso in Western Burkina) and on-farm demonstration trials of agronomic practices for striga control (around Fada N'gourma in Eastern Burkina).

In the Western part of the country, three maize varieties were used: TZE Comp 5W, SR 21, SR22, Obatampa, and Espoir. As much as possible, farmer variety was used as a check. Trials were conducted at Banakeledaga (5), Sakabi (5), Lena (7) Dankrouman (1) Toussiana (2), Taga (4), and Lesso (2). Each farmer trial consisted of three treatments [a farmer variety (check) between two improved (STR) maize varieties]. Plot size was 20X20 m for a total of 1200 m^2 per trial. Recommended fertilizer rate was used for all treatments.

A total of 26 trials were implemented in 8 villages **(Table 9).** Planting dates ranged from July 12th to August 23rd. Drought spells affected crop stand (8250 to 64750 plts/ha) and crop growth in most locations particularly during flowering. Five trials failed completely and were not harvested because of end of season drought spells. Striga count was also generally low and varied from trial to trial **(Table 9)**. However, the trend observed is that TZE comp5-W had the lowest striga count per plot (2366 plants) in general compared to the other varieties (Obatampa, 18444 plants; SR 21 18302 plants and SR 22,12796 plants)). Differences observed are not significant owing to the high level of variation between trials for striga count and plant density.

Grain yield also varied from 130kg/ha to 2504 kg/ha owing to drought effect. Yield of TZE Comp 5 W was comparable across locations with a mean yield of 1115 kg/ha compared to 876 kg/ha, 917 kg/ha 896 kg/ha and 644 kg/ha

Participating farmers discussing with techniciens before harvest of maize plots in Burkina Faso, 2004

Table 9. Mean agronomic and Striga data of varieties ..... sites in Burkina Faso 2004

variety	Density (Plants/ha)	Grain yield (Kg/ha)	Difference (Kg/ha)	Striga count (Plants/ha)%	SR21 (Check)	% farmer choice
TZECOMP.5-W	34679,2	1115,6	736,6	2366,7	125	90
Obatanpa	36127,8	876,4	715,3	18444,4	98	5
Espoir	37820,0	917,0	709,6	3196,4	102	5
SR21	34880,0	895,9	527,3	18302,5	100	0
SR22	19450,0	643,8	715,9	12796,4	72	0

respectively for Obatampa, Espoir, SR21 and SR22. TZE Comp 5W has a yield advantage of 25% compared to SR21 the recommended improved variety.

For two years, this variety has confirmed its advantage in terms of low striga count and higher grain yield compared to cultivated checks. Furthermore, this variety is expected to be recommended and provision made for seed production for further dissemination to farmers particularly in areas endemic to striga. Indeed, farmers overwhelmingly indicated their preference for TZE Comp5-W (90%) over the other varieties.

In Eastern Burkina Faso, on-farm demonstration trials on the efficiency of trap crop were conducted. This is a follow up to the trials implemented in the previous year, a maize cowpea rotation /intercropping trial was conducted by 8 farmers at Kouare. STR maize variety ACR 94 TZE Comp5-W, and cowpea trap crop variety KVX 61-1 were used.

Each farmer trial consists of a continuous cropping of ACR 94 TZE Comp5-W while the second treatment is a rotation between ACR 94 TZE Comp5-W and KVX 61-1 and the third treatment is intercropping of ACR 94 TZE Comp5-W and KVX 61-1 in the first year followed by pure crop of ACR 94 TZE Comp5-W the following years. Plot size was also 400 m². The two year results are on **table 10**. Striga infestation was generally higher in 2004 trials compared to 2003. Continous cropping of STR maize variety ACR 94 TZE Comp5-W has a higher striga count at the second year (4.5 plants/m²), while difference between rotation and intercropping was not significant. Significantly higher maize yield was also observed in the pure maize crop following cowpea or

Table 10: **Density of *S. hermonthica* and maize and cowpea grain yield in 2003 and 2004 in Eastern Burkina Faso**

	Striga Density		Grain yield kg/ha		
Treatment	Striga/hill 2003	Striga/m² 2004	ACR 94 TZE COMP.5W 2003	KVX 61-1 2003	ACR 94 TZE COMP.5W - 2004
Continuous maize cropping	0,8	4,50 a	362,5	-	762,50 a
Maize/cowpea rotation	-	1,99 b	-	457,0	956,25 b
Maizein rotation with intercropped maize with cowpea	0,2	2,13 b	477,1	577,7	975,00 b
ET		2,01			100,18
CV %		69,8			11,20

Means with the name letters are not significantly different

cowpea/intercropped with maize than the continuous cropping of STR maize.

It should be noted that after two year of trial, it can be noted, that STR variety ACR 94 TZE Comp5-W has been selected for dissemination to farmers in Western Burkina Faso, and that rotation between ACR 94 TZE Comp5-W and KVX 61-1 is recommended for striga endemic areas.

To sustain this effort, seed multiplication of the STR maize variety and the cowpea variety should commence. It is also expected the scaling up of the dissemination of these technologies with more farmers involvement through field days and farmer to farmer visit.

BENIN

In 2004, two types of on-farm trials were implemented in Benin: On-farm trial of STR maize varieties and dissemination of Acr 92 TZE Comp 5-W. These activities took place in the Atacora province, North of Benin.

The on-farm maize variety trial took place at the village of Ouoro, in Cobly district, where striga is endemic. A total of 15 farmers conducted the trials, 6 were in the second year and 9 were in the third year of trial (see table 11 for treatments).

For farmers conducted the trial for the second year, there was no significant differences among treatments for striga emergence, although a high level of striga count was recorded (8.3 plantes/m^2), or about 2,7 plants of striga per maize plants. This is expected since intercropping was used in combination with recommended fertilisation (200 kg NPK and 100 kg urea per ha). Maize yield was higher in intercroppings including Acr 97 TZL comp 1-W (4224 and 4000 kg/ha) compared to the one with farmer variety (2625 kg/ha). Average yield of TVX 1850-01F was 462 kg/ha when intercropped with Acr TZE Comp 1-W or farmer variety.

Farmers at third year of trial recorded significantly less striga count than those in the second year with an average of 3.7 plantes/m^2. There was no difference among treatments for striga count. STR maize variety Acr 97 TZL comp 1-W had higher yield than the farmer variety when intercropped with cowpea variety TVX 1850-01F, (4039, 3906 and 2972 kg/ha respectively in treatment 1, 2, and 3). As with farmers in second year of the trial, yield of cowpea was the same in all treatments (436 kg/ha).

Monitoring tour, northern Benin, 2004

Table 11. **Maize/legume intercropping and/or rotation in Benin, 2002 - 2004**

Treatment	First year	Second year	Third year
T1	Pure cowpea[1]	STR Maize[2]/ cowpea intercrop	STR Maize/ cowpea intercrop
T2	STR Maize/ cowpea intercrop	STR Maize/ cowpea intercrop	STR Maize/ cowpea intercrop
T3	Farmer Maize/ cowpea inter-crop	Farmer Maize/ cowpea intercrop	Farmer Maize/ cowpea intercrop

[1] TVX1850-01F

[2] Acr 97 TZL Comp 1-W

Each plot size was 400 m² with a population density of 62500 plantes/ha.

The trend observed is that successive intercropping of maize variety and trap crop cowpea reduces the level of striga emergence year after year. The result also indicates that on farm condition in northern Benin, STR maize variety Acr 97TZL comp1-W produces higher grain yield than farmer variety under moderate to high level of striga emergence.

Dissemination of Acr 92 TZE comp 5-W.

Previous results under the project have shown the superiority of Acr 92 TZE comp 5-W, as compared to local maize varieties which warranted its release to farmers. Due to lack of seed, however, it was decided that larger on-farm trial of this variety be conducted in combination with crop residue management in the cotton production area of northern Benin. 21 farmers undertook the activity with plot size of one ha each. In the first treatment, cotton residue was incorporated in the soil at tillage and in the second treatment, it was not. Very little striga emergence was recorded in these trials. Maize yield was also good 2927 kg/ha with no difference between the two treatments.

The third activity undertaken was the production of seed for the trap crop and the STR maize variety. A total of 850 kg of certified seed of Acr 92TZE comp 5-W and 650 kg of seed of TVX 1850-01F were produced.

MALI

The objectives of the project in Mali for 2004 were to conduct on-farm variety trials, and on-farm trial of agronomic practices to control striga.

The on-farm variety trials were conducted at the Niger River Bassin (OHVN) with 15 farmers for the second consecutive year. Maize varieties included Acr 94TZL W, EVDT 97 STRC 1, Dembanyuma and farmer

Table 12. **Level of *Striga hermonthica* emergence in 2004 in Mali**

Treatments	Striga count 60 DAP	Striga count 75 DAP	Striga count 90 DAP	Striga count At harvest
T1= Across 94 TZL W	73	116	160	160
T2 = EVDT 97 STRC1	76	117	178	178
T3 = Variété locale	79	127	173	173
T4 = Dembanuma	70	126	179	179
Signification	NS	NS	NS	NS
CV %	41,22	31,91	26,56	26,56

Table 13. **Yield and yield component on farm variety trial 2004, in Mali**

Treatments	# Harvested Plants	# Cob Harvested	Cob weight	Grain weight	Yield t/ha
T1= Across 94 TZL W	230	116ab	12,6ab	9,02ab	902 ab
T2 = EVDT 97 STRC1	295	187a	14,55a	9,86a	987 a
T3 = Variété locale	307	167b	10,68b	6,86b	687 b
T4 = Dembanuma	342	184a	15,92a	10,70a	1070 a
Signification	NS	S	S	S	S
CV %	24,20	24,87	26,06	26,23	26,23
LSD	-	3,40	3,40	2,32	232,5

Table 14. **Treatments for the on-farm agronomic practices trial in Mali**

Treatments	1st year 2002	2nd year 2003	3rd year 2003
T1	TVX 1850-01 F	Acr 94TZL W	Acr 94TZL W
T2	EVDT 97 STRC 1	TVX 1850-01 F	Acr 94TZL W
T3	EVDT 97 STRC 1/ TVX 1850-05 F	TVX 1850-01 F/ Acr 94TZL W	Acr 94TZL W
T4	Farmer variety	Farmer variety	Farmer variety

variety as a check. Plot size was 100 m² Fertilizer was applied at planting and during crop growth (100 kg/ha NPK + 150 kg/ha Urea).

Striga emergence was moderate in all plots and differences observed were not significant. Dembanuma seems to have the highest striga count and Acr 94 TZL W the lowest **(Table 12).**

Significant grain yield differences were observed among the varieties with Debanuma having the highest grain yield **(table 13)**. Yield of Acr TZL W was not significantly different to that of the local variety. Low yield could be explained by the rainfall which was relatively low in 2004, as well as the late planting.

On-farm trial of agronomic practices to control striga.

Twelve on farm agronomic trials were conducted at Kolokani. The objectives were to evaluate the effectiveness of STR maize varieties in rotation or intercropping with trap crop legume for the control of striga. This trial has been conducted for the fourth year according to the treatments in table 14. Plot size was 100 m².

Striga count was generally low in these trials with an average of 11 striga plants/plot for the farmer variety while Acr 94 TZL W had between 4 to 8 striga plants/plot. Observed differences were significant at harvest.

Grain yield was low owing to the late planting and less than average rainfall. Overall, the grain yield of Acr 94 TZL W was higher than that of the farmer variety (108 kg/ha).

Results in Mali in 2004, were affected by late planting and low rainfall. Striga incidence was also moderate, but the rotation and or association of STR variety Acr 94TZL W with cowpea variety TVX1805-01F had exhibited better performance to striga emergence as well as grain yield.

NIGERIA

In northern Nigeria, the objectives of the project were to promote STR maize varieties and related crop and soil management practices with the view to combatting striga. Three types of acti-

Table 15. Production of cowpea and maize seed in Nigeria, 2004

Location	Cowpea seed (kg)		Maize seed (kg)	
	Qtity Produced	Qtity Recovered	Qtity Produced	Qtity Recovered
Tahan dole (SS)	105	35	263	54
U/Shamaki (NGS)	1250	417	1100	367

vities were undertaken: training of farmer in seed production, training of farmers in striga biology and control, and implement STR maize variety trial and maize legume rotation trials.
On-farm variety trials were conducted on 10 farmers fields in the Sudan Savannah. Varieties evaluated against farmers local variety are: extra early varieties (Syn 2000EE-W and 99TZEE-Y STR) and early varieties (EVDT-W99 STR Co and Acr 94TZE Comp. 5-W). Each farmer evaluated one set of early or extra early STR maize variety against his own local cultivar. Plot size was 400 m^2, and recomended maize production practice was used including fertilizer and weeding whenever necessary. It should be noted that maize density at harvest was very low. Equally low striga count was recorded.

Extra early maize varieties supported fewer striga plants and had less number of plants infested by striga had less striga damage than the farmer own variety. However, they had shorter plants with shorter ear height. The grain yield of Syn 2000EE-W and 99TZEE-Y were 24% and 22% higher than the farmers' variety respectively. Farmer variety also had a lower plant density compared to the STR extra early maize varieties.

The STR early maize varieties (EVDT-W99 STR Co and Acr 94TZE Comp. 5-W) supported fewer striga plants, had less number of plant infested and had less striga damage than the farmer maize variety. Grain yield was also higher for the improved STR varieties compared to the farmer varieties (33 and 44% respectively).

On-farm crop rotation was conducted on six farmers' field in the Sudan savannah. This two year rotation trial which started in 2003 involved a first year cropping of a soybean

Maize plots in northern Nigeria, 2004

trap crop cv. TGX 1448-2E or cowpea cv. IT93K452-1 followed the second year by an STR maize variety Acr.97TZL Comp 1-W. The legume/STR maize rotation is compared with a continuous cropping of farmer maize variety.

Results indicated that rotation with either cowpea or soybean supported fewer striga plants and showed less damage to striga compared to continuous sole cropping of farmer maize variety. Grain yield advantage of Acr 97 TZL comp 1-W over continuous sole cropping of farmer variety was 44% and 4% higher when rotated respectively with soybean and cowpea.

Farmer had a very good perception on the STR maize with more than 80% preferred the new varieties to their own local cultivar. The criteria which were most important to farmers include high yield and tolerance to striga, early maturing good seed color and palatability.

The seed production exercise was meant to train extension agents and farmers in the production of pure high quality seed and to subsequently set up a community seed production scheme. A revolving funds was also established to insure sustainability of the project. The quantity of both maize and cowpea seed produced is in the **table 15**.

About 72 participants including extension agents, farmers received training on striga biology. The training was conducted in Hausa and had the support of the traditional leaders.

CAMEROON

In 2004, three types of activities aimed at controlling striga were conducted in Cameroon. These activities covered 2 agroecological zones viz Sudan savannah and Northern Guinea savannah. In all activity, plot size used was 20mx20m except for seed production where plot size of 50mx50m was used.

One field day was organized at Gatougel which attracted about 150 farmers. Prof. S.T.O. Lagoke of the University of Abeokuta, Nigeria attended this field day as a member of the annual monitoring team of the project.

On-farm demonstration trials

The on-farm demonstration trials consisted of 21 on-farm variety trials, 11 on-farm rotation trials and the same number of intercropping trials. Three varieties (Advanced NCRE, Cam inb STR-Y, and STR-Y) were compared with farmer local variety in the on-farm variety trial. The rotation trial consisted of 3 plots. The first plot which had cowpea in 2003 was planted with STR-maize and the second plot which had maize in 2003 was planted with leguminous crop in 2004. The third plot received a continuous pure cropping of farmer variety each year. The on-farn intercropping trial consisted of two treatments of a) STR-maize intercropped with cowpea planted one month later and b) local maize planted as sole crop.

Results indicated that in the Guinea Savannah, grain yield obtained in Sanguere Ngal and Djalongo **(Table 16)** were better than the one obtained in Badankalli. This could be explained by the higher striga infestation 197 striga plant emerged per 400 m^2 (4925 striga plants/ha) in Badankalli.

A significant difference was observed for grain yield and the number of striga plant emerged among the four varieties evaluated. STR varieties yielded 47% better than the local CMS

Striga infested plant in northern Cameroon

Table 16. **Means performances in Guinea Savannah in 2004**

Localité	Grain yield	% Control	STR Count	%	PAH	EAH
Sanguere Ngal	2936 A	-	168	-	247 A	197 A
Badenkalli	2524 B	-	197	-	220 A	197 A
Djalingo	2748 AB	-	160	-	270 B	225 B
TRIALS TYPES						
Variety trials	2888 A	-	181 A	-	254 A	238 A
Rotation trials	2831 A	-	157 C	-	258 A	234 A
Intercropping	2743 A	-	129 B	-	232 B	227 A
VARIETY						
Advanced NCRE	3852 A	147	201 A	72	252 A	246 A
Cam Inb STR -Y	3903	148	176 AB	63	258 A	252 A
STR-Y	3789 A	145	153 B	55	247 A	243 A
Local	2617 B	100	278 C	100	197 B	182 B
Mean STR	3848	147	177	64	252	247

8501. No significant differences were detected among the 3 STR varieties even-though, Cam Inb Str exhibited 1% and 3% grain yield superiority over Advanced NCRE and STR-Y, respectively. STR variety also showed 36% less striga plant emerged than the local CMS 8501. The STR variety was STR-Y which showed 8% and 17% emerged less striga plant than Cam Inb STR and Advanced NCRE respectively.

Maize crop in northern Cameroon 2004

The 3 types of on-farm trials conducted in this zone yielded similar results. However, inter-cropping exhibited significantly less striga plant emerged (3225 striga plant ha^{-1}). This was followed by rotation (3925 striga plant ha^{-1}). This represented 18% less striga plant emerged. It was better than the 27% difference observed in 2003.

As shown in **table 17**, grain yield in Sudan savannah were 42% less than grain yield obtained in Northern guinea savannah. From farmer appreciation, most of Sudan savannah fields (76%) were highly infested by striga. In addition to striga damages, sole late-planted fields got hit by terminal drought, which occurred, between late August and early September.

Grain yield obtained in the 2 locations was similar. Bougaye yielded 18% more than Ouro Dadjam. In Sudan savannah, no significant differences were detected among the 3 types of trial management. The 3 STR maize yielded 37% more than the

Table 17. **Means performances of maize in Soudan Guinea Savannah**

Localité	Grain yield	% Control	STR Count	%	PAH	EAH
Ouro Dadjam	1789 A	-	-	-	242 A	233 A
Bougaye	2103 A	-	-	-	265 A	242 A
Trials type	2333 A	-	-	-	262 A	234 A
Variety trials	2218 A	-	-	-	247 A	221 A
Association	1836 A	-	-	-	257 A	228 A
Rotation						
Variety						
Advanced NCRE	2432 B	149	-	-	276 B	241 A
Cam Inb STR -Y	2078 B	127	-	-	256 B	237 A
STR-Y	2211 B	135	-	-	266 B	231 A
Local	1632 A	100	-	-	234 A	228 A
Mean STR	2240	137	-	-	265	236

local maize CMS 8501. Advanced NCRE exhibited 49% more grain yield than the control, 14% more than STR-Y and 22% more than Cam Inb STR.

STR Maize seed diffusion

To scale up diffusion of proven technologies, 540 farmers were provided with 3 kg of STR maize seed of their choice and 1 kg of cowpea each. This activity involved 8 villages, among which Bougaye and Badenkalli which were new villages in the system.

Farmers were tought how to use the technology appropriately and advised to show their farms to other farmers. A questionnaire was administered to them after harvest, in an attempt to evaluate the impact of improved STR-maize.

The farmers' characteristics and cultivars appreciated are shown on table 4. Out of the 540 farmers sampled, 9% were female and 91% male. More females (11%) conducted the diffusion trials in the Sudan savannah zone. 33% of the farmers were 40 years old and above. 62% were between 20 and 40 years old, while only 5% were in the two agro-ecological zones.

68% of the farmers planted the Advanced NCRE that was also recommended by extension agents. 21% planted the Cam Inb STR with yellow grains and only 3% preferred STR-Y. It was noted that 8% of the farmers, who received STR-seed, planted their local maize which was either the early CMS 9015 or the intermediate maturity cycle CMS 8501. In Sudan savanna, 98% of the farmers planted STR maize and 85% in the Northern Guinea savannah. This was partly explained by the fact that Northern Guinea savannah farmers have been exposed to maize cultivar much longer than Sudan savannah farmers and were more reluctant to change, especially if striga is not a big problem to them.

Farm management and striga emergence varied according to agroecological zones.

In 2004, 76% of Sudan savannah farmers declared that their fields were heavily infested, and 18% had a few striga plant in their fields. In Northern guinea savannah, only 16% of the fields were heavily infested while 35% had some striga plant in their fields. In this zone, 49% of the farmers did not have any striga in their fields.

59% of the farmers used fertilizer. More Northern guinea savannah (85%) used fertilizer compared to 34% observed in Sudan savannah. This partly explained why more fields (76%) were heavily infested in Sudan savannah than in Northern guinea savannah (16%). 23% of

Table 18. **Average maize grain yield in the diffusion trial**

Maize grain yield (kg/ha)	Sudan Savannah	Northern Guinea vannah	Average
Less than 2000	97.4	81	90
2000-4000	2.1	16.4	8.6
More than 4000	0.5	2.6	1.4

farmers did not use cowpea as trap crop, 70% planted maize in rotation, 5% and 15% had very good fields in Sudan and Northern guinea savannah, respectively. In 2004, 68% of Sudan savannah farmers had very poor fields while only 9% of northern guinea savannah experienced poor harvest.

Maize grain yield was less than 2000 kg/ha in 90 % of participating farmers overall. (81% in Northern Guinea Savannah and 97% in Sudan Savannah) **(Table 18)** . In general, farmers had better maize grain yield in NGS than in SS where field were more infested with striga (76%). In this area, farmers preferred STR maize varieties over their local variety compared to 66 % in the Sudan Savannah.

On-farm community STR maize/ cowpea seed production

To sustain the promotion of the improved STR maize seed, nine farmers embarked on seed production in 2004 in Gatougel. Field were selected to insure proper isolated in collaboration with the IRAD maize program. Plot size was 50 mx50 m. A revolving fund was established using 1/4 of the quantity of seed produced by the farmers.

In general, farmers reported less seed quantity than actually produced. This was to avoid returning more seed to the programme. As reported in **table 19**, 4.0 ha was used in the scheme to produce 4600 kg of STR maize seed for an average 1150 kg ha^{-1}, which is better than in 2003. Advanced NCRE was the most produced variety because of its while color.

Results obtained confirmed superiority of STR cultivar over local maize by at least 37%. The superiority of STR cultivar over local was more evident in Northern guinea savannah than in Sudan savannah. Beside different rainfall observed between these 2 zones, the yield superiority could partly be attributed to less *striga hermonthica* infestation observed in guinea savannah as compared to Sudan savannah.

It was concluded that, due to the fact that no grain yield differences were observed among the three cropping systems, intercropping which resulted in significant lesser number of striga plant emerged would be the best striga control technology for both Sudan and Northern guinea savannah. This cropping system has the advantage of producing additional cowpea grain for the farmer each year.

Table 19. **Community based seed multiplication in Cameroon 2004**

Agro-Ecological Zones	Villages	Number of farmers	Land area	Varieties	Yield reported (kg)
Soudan Savannah	Guidiguis	2	1.0 ha	STR-Y	800
			0.5 ha	Advanced NCRE	200
Guinea Savannah	Sanguere	2	0.5 ha	STR-Y	950
	Ngal	2	1.0 ha	Cam Inb STR	1350
	Badenkalli	3	1.5 ha	Advanced NCRE	1300
	Djalingo	(4)	(2.0 ha)	Advanced NCRE	2700
	Gatougel*				
TOTAL		**9**	**4.0 ha**		**4600**

* Not in Total

Conclusions and Recommendations

In 2004, implementation of the korean/African Union project on Striga research and control was actively pursued by the six west and central Africa participating countries. Increasing number of farmers were reached in 2004, with 1221 of them participating in technologies diffusion. This number represented 44.3% increase over 2003.

In addition, through the community based seed production scheme, all countries produced enough seed for the 2005 project activities. In fact, more than 11000 kg of seed were produced in 2004, as compared to the 3975 kg of STR-maize seed produced by 4 countries in 2003. This represented a 17 % increase over 2003. Technologies demonstrated usually outyielded the farmers practises. In fact, maize grain yield superiority of the project technologies over the farmers practices ranged from 13% to 57%. This was partially explained by lesser (28% to 60%) Striga plant emerged observed on STR-maize. This clearly demonstrated that the technologies demonstrated were efficient in reducing the Striga seed bank. In 2004, after the production of a videotape film on project achievements, organized field days monitoring tours training and organized farmers survey permitted to assess progress so far achieved and to assess the farmers perception of the demonstrated technologies.

The following recommendations are made for future project implementation in order to achieve the projet main objective, which is to sustain food security and poverty alleviation through solving the Striga problems.

- STR-maize superiority as well as appropriate cropping system were observed in all countries. Better management of the demonstration plots are encouraged especially in Mali, and in Soudan Savanna of Burkina Faso.

- STR-maize seed increase was done by all participating countries. It's therefore recommended that large scale sdiffusion of proven technologies should be pursued by all country in order to reach a larger number of farmers.

- Field days are deamed compulsory to all countries is order to sensitise all stake holders on striga problem.
  This is also a venue to expose farmer to other options available for striga control.

- All participating NARS should document country achievements and provide indicators of impact, for and internal evaluation of the project.
  It is also recommended that impact assessment and an external evaluation of the project, be planned provided that more funds are available.

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