AFRICAN UNION
Scientific, Technical and Research Commission
Semi-Arid Food Grain Research and Development

UNION AFRICAINE
Commission Scientifique, Technique et de la Recherche
Recherche et Développement des Cultures Vivrières dans les Zones Semi-Arides

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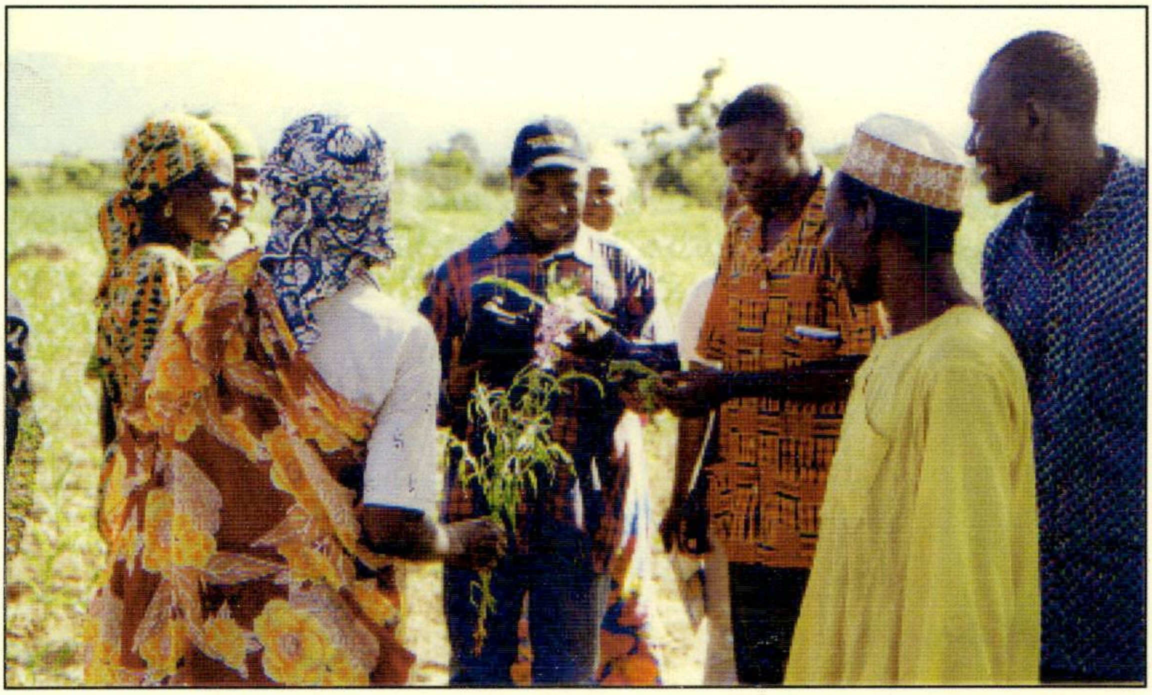

Korean Government - AU/STRC-SAFGRAD African Striga Control Program

Funded by:

The Government of the Republic of Korea through the International Agricultural Research Institute (IARI) of Kyungpook National University and the African Union through SAFGRAD

May 2003

About SAFGRAD

The Semi-Arid Food Grain Research and Development of the Scientific, Technical and Research Commission of the Organization of African Unity (OAU/STRC-SAFGRAD) established in 1977 to advance agricultural research, development, and natural resource management in semi-arid ecology in more than 30 countries of Sub-Saharan Africa.

For more than two decades, OAU/STRC-SAFGRAD has mobilized scientific talents and resources of National Systems and those of International Agricultural Research Centers (IARC's) to enhance food security and sustainable agricultural development.

To contribute to Africa's food production increase and poverty alleviation challenges, SAFGRAD has revitalized and broadened its program scope to make small-farm holdings more profitable. The four new niches of SAFGRAD included: first, to promote linkage of agricultural production to small and medium-scale industries to enhance the transfornation of agricultural produce into value-added products; second, diversify farm enterprises by integrating on-farm production systems to induce complementarities and synergies in the use of resources, generation of income and employment; third, promote demand-driven research and packaging of more productive technological options to increase agricultural production and productivity and fourth, to promote the development of agricultural production and productivity and fourth, to promote the development of agribusiness by exploiting both local and export markets.

The main thrust of SAFGRAD program is to:

I. Enhance agricultural research and development capabilities of members states through short and long-term training;

II. Facilitate addressing agricultural policy issues through conferences, workshops, symposia and government contacts;

III. Promote the transfer, adoption, and commercialization of agricultural technologies to generate income and employment in sub-Saharan Africa;

IV. Facilitate the industrial transfromation and utilization of food grains into value-added products;

V. Promote productive agriculture and environmental conservation through an integrated farming systems;

VI. Build the knowledge base on semi-arid agricultural in SSA through its publication, specialized seminars, etc.

Within the Scientific, Technical and Research Commission of OAU, SAFGRAD is governed by the Regional Technical Advisory Council comprised of representatives from various organizations.

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

Country	Collaborating Institutions	Team Leader
Benin	Institut National des Recherches Agricoles du Bénin, BP 128 Porto Novo Benin Republic	Dr. G. Gbehounou
Cameroon	Institut de la Recherche Agricole pour le Développement IRAD, Yaoundé	Dr. Charles The
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'élevage et de la Pêche, République du Mali	Dr. N. Coulibaly
Nigeria	Institute of Agricultural Research Ahmadu Bello University, Zaria	Dr. I. Kureh
	University of Agriculture, Abeokuta	Prof. S.T.O. Lagoke

Executive Summary

To strengthen control efforts for striga, a parasitic weed that devastates maize and other cereals in sub-Saharan Africa, and for sustained increased maize productivity, the Korean-Government-AU/STRC-SAFGRAD funded striga control project was scaled up in 2002 for increased impact. A host of activities was undertaken in the ecologies where striga inflicts the greatest damage in West and Central Africa viz. Southern Guinea, northern Guinea and Sudan savannas. These included primarily on-farm demonstration of a few number of environment-friendly striga control options considered to have the greatest potential for adoption, notably maize intercropping and rotation with legumes such as cowpea, soybean and groundnut. Other activities included varietal trials to identify most appropriate striga tolerant/resistant (STR) cultivars in cases where such information do not already exist, research institute and community-based seed production, farmers' field days and field survey. These activities were monitored for implementation during the scientific monitoring tour that covered Benin, Cameroon, Cote d'ivoire, Ghana and Nigeria.

The project was able to reach a greater number of farmers than was achieved in previous years through one or more of its activities. The farmers reached in these countries totalled 1268 with 87 in Benin, 721 in Cameroon, 241 in Ghana, 26 in Mali, 173 in Nigeria and 20 in Cote d'Ivoire. A major limitation to reaching even a greater number of farmers was availability of striga tolerant/resistant maize cultivars. The community based seed multiplication of STR cultivars has the capability to solve this problem. Consequently seeds of STR varieties were produced in farm communities in Cameroon (a total of 6,125 kg of three STR cultivars) while seeds of appropriate legumes for intercropping were produced in northern Nigeria (a total of 2,758 kg of cowpea cultivar IT93K452-1 and 3,114 kg of soybean cultivar TGX 1448-2E). These seeds will, in part, form the seed input for the trials of 2003. Hitherto provision of seeds of STR cultivars of maize has been to a large extent by the International Institute of Tropical Agriculture (IITA), Ibadan, Nigeria, and to some extent by the Cameroon maize breeding program. The involvement of communities in the production of seeds of STR cultivars will, in addition to empowering farmers that are involved in the project, make for sustainability.

Considerable success was achieved in the execution of the on-farm demonstration trials in 2002. STR cultivars showed better performance than the farmers' variety by up to 200%, and farmers selected STR varieties although grain yield was not the only criteria. While yield decline of maize in intercrop with legume was commonly observed, such yield decline was readily compensated for by the grain yield of the legumes. In particular soybean showed tremendous promise in northern Ghana and northern Nigeria. The benefits of rotation with legumes can only be clearly evident after few to several years. Results of maize yields from the demonstration trials of 2003 on plots previously planted to legumes should demonstrate the advantage of the latter to control striga and improve crop environment for higher yield. During the monitoring tour carried out between July and August 2002, legume intercropping in wide strips with sorghum alternated on single ridges had substantial amount of striga, thus suggesting that effective striga control options may require excluding sorghum from crop combinations. Striga is more adapted to sorghum than maize. Survey data from northern Nigeria supports this observation that sorghum is a major crop contributing to increased striga seeds in cereal fields in sub-Saharan Africa. Results from Cote d'Ivoire was not included in this report due to the political crisis in the country.

Documentation of impact of the project can be further enhanced by pictures and video recording. Participating countries are encouraged to engage in proper documentation of achievements. This can be used as a springboard for extending the achievements to other countries in the sub-region where striga also poses a problem.

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Introduction

Maize, an important cereal crop in Africa, is expected to continue to be prominent in the socioeconomic life of people of the continent. The popularity of the crop derives from its ease of cultivation, high response to inputs and the high level of diversification of the food forms prepared from the grain. Notwithstanding the widespread cultivation of maize in Africa, the continent imports about 12 millions tons of maize grain annually. With increasing human population expected to shoot over 1.3 billions in 2025, demand for maize is expected to increase. At the present level of productivity, the continent will need to import 27 millions tons to meet her need in 2025.

The production potential of maize cultivars developed for cultivation in Sub-Saharan Africa, where the bulk of the maize is grown in Africa, is hardly realized. A realization of this potential, expected to be facilitated by the removal of prevailing local biotic and abiotic constraints, will reduce the maize grain importation by countries of the continent. One of the major constraints has been the parasitic weed, *Striga*, several species of which devastate maize fields and fields planted to other cereals in sub-Saharan Africa. Most notable and most widespread, but not necessarily the most destructive among them is *Striga hermonthica*. Yield loss for maize due to *S. hermonthica* is frequently more than 50%. A more recent yield loss estimate for maize grown on moderately to highly infested fields in West and Central Africa is 68%.

Considerable efforts by International Agricultural Research Centres (IARCs), and National Agricultural Research Systems (NARS) have been devoted to solving the striga problem in Africa. Reasonable progress has been made, especially in maize as evidenced by the development of tolerant/resistant varieties and appropriate cropping systems. The cropping practices include rotation with legumes such as cowpea and soybean, both of which have the capacity to stimulate suicidal germination of *S. hermonthica* as well as fix nitrogen through symbiotic association with soil rhizobia. The fixed nitrogen is available to an incoming cereal, consequently reducing the external nitrogen requirement for a successful crop. The maize –legume rotation system is considered cheap, environment friendly, sustainable and appropriate for the prevalent low input agricultural system in Africa. Maize-legume intercropping provides similar benefits with the difference that cultivation of these crops occur simultaneously on the field. The maximum benefits of the developed striga control technologies are, however, yet to be felt.

While other farm-level-feasible panacea to the striga problem can continue to the sought in experimental fields and laboratories of IARC's and NARS, it is the general consensus that the available technologies of legume rotation and legume intercropping with cereals are effective enough, especially in maize where striga tolerant/resistant cultivars exist. Although STR maize cultivars are very effective on their own, their effectiveness is better enhanced with legumes, either intercropped or planted in rotation.

The Korean Government-AU/STRC-SAFGRAD inititative for striga control in Africa, jointly funded by these parties and implemented by SAFGRAD since 1999, has been able to demonstrate and deliver these striga control technologies to farmers through collaborative activities with National Agricultural Research and Extension Systems (NARES) and the West and Central Africa Maize Network, (WECAMAN) with technical backstopping provided by IARC's (IITA and CIMMYT) and with the International Agricultural Research Institute (IARI) of Kyungpook National University (KNU), Taegu, South Korea as facilitator. The multi-agency nature of the striga control project is expected to promote synergy, strengthen partnership among stakeholders and provide for complementarity of resources, especially intellectual, all of which have implications for success at the regional level.

In 2002, a scaling up of the striga control activities was vigorously pursued. The scaling-up was aimed at reaching a larger number of communities and getting to a larger number of farmers plagued by the striga epidemic, all towards assisting the region to achieve increased maize productivity and food security.

Activities and Strategy of Implementation of Project for 2002

STRIGA TASK FORCE

Activities for 2002 started with a meeting of the Striga Task Force, which was held at the International Institute of Tropical Agriculture (IITA), Ibadan, Nigeria between 4-5 April 2002. Participants at the Striga Task Force meeeting are listed in Appendix 1. The thrust of the meeting was to review the achievements of the project to date, develop a plan for the year as well as fashion out appropriate strategy for its implementation. After careful deliberations, the Striga Task Force agreed on the need to:

- narrow down striga control options for demonstration to the few ones with the greatest potential for adoption;
- scale-up the demonstration of the limited number of most promising options by increasing the number of ecological zones, villages and farmers for maximum impact;
- work towards greater involvement of some partners such as private seed companies, seed production units of NARS and community seed producers;

• ask participating countries to urgently submit proposals for 2002.

COUNTRY PROPOSAL REVIEW

Proposals received from six countries (Benin, Cameroon, Cote d'Ivoire, Ghana, Mali and Nigeria) were reviewed at SAFGRAD on 27 May 2002. Participants at the proposal review were Drs. Charles The, Mahama Ouedraogo and Victor Adetimirin. The team made suggestions and recommendations in respect of individual proposals, which were forwarded to participating national programmes. In addition, proposals were harmonized for protocols such as plot size, nature of treatments and data to collect for on-farm demonstration. For example, plot size of 20 m x 20 m was recommended for each treatment on-farm. Also, suggestions were made on the need to keep the trials simple. Only three treatments, and by implication three plots, were suggested for rotation trials. One of the three plots will be planted to the farmer's variety every year. The remaining two plots should be planted one to an STR cultivar and the other to a legume. The treatments planted to the latter plots are rotated every year such that maize follows a legume crop and vice versa.

MONITORING TOUR

A monitoring tour team comprising of six members visited on-farm demonstration trials in Cote d'Ivoire, Ghana, Nigeria and Cameroon between 30 July and 18 August 2002. The team comprised of Prof. and Mrs Soon-Kwon Kim, Director General, International Agricultural Research Institute (IARI), Kyungpook National University (KNU), Taegu, South Korea, Dr. Mamadou I. Ouattara, International Coordinator, SAFGRAD, Burkina Faso, Dr. Mahama Ouedraogo, Regional Agronomist, SAFGRAD, Burkina Faso, Dr. Charles The, SAFGRAD Consultant, IRAD, Cameroon and Dr. Victor O. Adetimirin, SAFGRAD Consultant, University of Ibadan, Ibadan, Nigeria. Dr. Victor Adetimirin later visited trials in Benin Republic between 8 and 12 October.

The monitoring tour has as its objectives the assessment of the implementation of the project, interaction with farmers to obtain information on their perception of the project as well as provide opportunity to make recommendations to address observed shortcomings. In addition to visit to demonstration sites, the team visited the International Institute of Tropical Agriculture (IITA) headquarters at Ibadan, Nigeria, IITA experimental field at Abuja, Premier Seeds Limited, Chikaji, Kaduna State, Nigeria, and the FAO Regional Plant Protection Office, Accra, Ghana. A detailed report of the monitoring tour has been produced and included other observations relevant to food security in the sub-region such as the devastating viral disease on coconut and black sigatoka on plantains and bananas.

ON-FARM ACTIVITIES

Activities carried out on-farm during 2002 included on-farm demonstration of striga control technologies mainly STR maize cultivars in rotation or intercropped with legumes, STR varietal trials, community seed production, farmers' field day, training of farmers and farm survey. A total of 1257 farmers were reached in the six participating countries for the various activities ; 87 in Benin,721 in Cameroon, 241 in Ghana, 15 in Mali, 173 in Nigeria and 20 in Cote d'Ivoire (Table 1).

For the six countries involved in the project, a total of 11 maize cultivars were used, two each in Benin, Ghana and Mali, three each in Cote d'Ivoire and Nigeria and four in Cameroon (Table 2). It was only in Nigeria that all three legumes were used; groundnut in the forest-savanna transition zone, and cowpea and soybean

Table 1: Number of farmers eached in participating countries

ACTIVITIES	PARTICIPATING COUNTRIES													
	Benin		Cameroon		Ghana		Mali		Nigeria		Cote d'Ivoire		TOTAL	
	Number of villages	Number of farmers	Number of villages	Number of farmers	Number of villages	Number of farmers	Number of villages	Number of farmers	Number of villages	Number of farmers	Number of villages	Number of farmers	Number of villages	Number of farmers
On-farm variety demonstration			10	42	-	-	1	14	-	-	-	20	11*	76
On-farm rotation demonstration	5	30	8	27	6	20	1	12					20	89
On-farm intercroping demonstration	4	57	9	30	6	26			7	70			26	183
Total number of farmers involved in demonstration		**87**		**99**		**46**		**26**		**70**		**20**		**340**
Country seed production			5	9					3	3			8	12
Field days			3	295					3	100			6	393
Training/meeting			10	320	6	195							16	515
Total number of farmers reached		**87**		**721**		**241**		**26**		**173**		**20**		**1268**

in the savanna. In the other countries the choice of legume was either cowpea or soybean. Soybean was used in Ghana and Nigeria while cowpea was the legume of choice in the remaining countries.

Although hamonization of trials were sought at the onset of the project, this was hardly completely achieved in all countries, especially with respect to plot size. In some countries such as Mali and Nigeria, enough land to accomodate the 20 m x 20 m specified for each on-farm treatment was not available. Consequently, plot sizes were reduced but maintained at acceptable levels.

Table 2. **Maize and legume cultivars used in the on-farm demonstration trials for striga control in West and Central Africa in 2002.**

Country	Maize		Legumes[a]		
	No.	Varieties	Cowpea	Soybean	Groundnut
Benin	2	Acr 97 TZL Comp 1-W Acr 92 TZE Comp 5 W	TVX 1850-01	-	-
Cameroon	4	Acr 97 TZL Comp 1-Y Cam Inb Str Str-Y Advanced NCRE	X	-	-
Cote d'Ivoire	3	Acr 97 TZL Comp 1-W Acr 97 TZL Comp 1-Y IWD STR C1	X	-	-
Ghana	2	Acr 94 TZE Comp 5-W IWD STR C1	-	X	-
Mali	2	Acr 94 TZE Comp 5-W EVDT 97 STR C1	TVX 1850-01	-	-
Nigeria	2	Acr 97 TZL Comp 1-W Acr 94 TZE Comp 5-W Oba Super 1	IT93K452-1	TGX14482E	RMP 91

[a]X indicates the legume used in intercropping or rotation trials ; varieties of legumes used need to be ascertained.

Country Activities and Achievements

BENIN

On-farm demonstration activities were carried out in 4 locations in the Atacora district viz. Koudougou, Kouya, Nanagade and Ouorou. This involved intercropping cowpea variety TVX 1850-01F with either Across 97 TZL Comp 1-W or the farmer's variety. A third plot was sole cropped to cowpea in 2002 and will be planted solely to STR maize in 2003. The advantage of this design is that legume intercropping and rotation are simultaneously presented to farmers in a non-complex demonstation. Intercropped plots had maize planted at 0.80 x 0.40 at two plants per hill while two hills of cowpea were established between two hills of maize. Differences bewteen the intercropped STR maize cultivar and the intercropped farmer's variety were not significant. The performance of the STR cultivar is presented in Table 3. Yield of Across 97 TZL Comp 1-W at Kouya and Ouorou was on average about twice the yield at Koudougou and Nanagade. These results suggest certain locations may better optimize the potential of STR cultivars. Cowpea yield was highest in Koudougou and, as with maize grain yield, was lowest in Nanagade. Nanagade appears to be a low productivity environment for both maize and cowpea. Specific factors that contribute to this low productivity need to be investigated. Intercropping with maize reduced the yield of cowpea. Cowpea yield from intercropped plots averaged 35% of the yield of the sole crop in Koudougou, 34% in Kouya, 46% in Nanagade and 32% in Ouorou. Yield loss in maize due to intercropping could not be ascertained since there was no sole maize plot among the treatments. Intercropped plots had both *S. hermonthica* and *S. gesnerioides*. Maize yield from intercropped plots was not related to the severity of striga incidence as the highest maize yields were obtained in locations with the highest number of emerged striga plants. Given the incidence of *Striga gesnerioides* in intercropped plots it is important for cowpea cultivars selected for intercropping to not only stimulate suicidal germination of *Striga hermonthica* seeds but also to minimize its support of *S. gesnerioides*.

Across 92 TZE Comp. 5-W was tested in pre-extension trials, a standard practice before proper on-farm trials in Benin. Across 92 TZE Comp. 5-W intercropped with cowpea cultivar TVX 1850-01F showed a significantly higher yield (difference of 252 kg) than the farmer's variety intercropped with the same cowpea cultivar, hence demonstrating a potential for extension to farmers.

Table 3. **Mean performance (± se) of component crops of an intercrop system involving STR maize (ACR 97 TZL COMP 1-W) at four locations in Benin Republic.**

Location	*Striga hermontica*	*Striga gesnerioides*	Intercrop yield		Cowpea sole crop yield*
			Maize grain	Cowpea grain	
	no./m-2		kg ha-1		
Koudougou	1.6 ± 0.3	3.8 ± 1.4	1088.7 ± 88.9	334.9 ± 28.9	960.4 ± 73.3
Kouya	2.7 ± 0.4	0.2 ± 0.2	2312.6 ± 251.4	182.3 ± 58.2	539.1 ± 119.3
Nanagade	1.0 ± 0.1	0.0 ± 0.0	1036.5 ± 94.4	139.4 ± 32.6	304.7 ± 66.5
Ouorou	4.8 ± 0.5	0.5 ± 1.5	2437.5 ± 143.5	238.3 ± 120.1	754.5 ± 196.3

Cowpea variety used in the intercrop was TVX 1850-01F ; the variety is known to be efficient at stimulating suicidal germination of *S. hermonthica* seeds.

GHANA

Both intercropping and rotation with legumes were successfully demonstrated in the districts of Tamale, Tolon-Kumbungu, Yendi, and Bawku East. For the intercropping trials two of four plots were intercropped with soybean using the paired row system (i.e. two rows of maize alternated with two rows of soybean) while the remaining two plots were sole-planted, one each to the farmers cultivar and an STR cultivar. In the intercropping trials more striga plants were, in general, observed in sole than intercropped plots. Grain yield appear to depend more on each farmer's level of management. Yield reduction was observed for maize in intercropped plots, a consequence of the lower maize stand per plot. However, the yield obtained from the soybean more than compensated for the reduced maize yield, especially given the high commercial value of soybean in the market.

In addition to the on-farm demonstration trials, Agricultural Extension Agents (AEA's) and District Development Officers (DDO's) were trained in striga management. This is because it is imperative for the AEA's and the DDO's to be able to answer farmers' questions regarding striga on the spot without having to see the researchers. In all a total of 195 AEA's and DDO's were trained ; 27 in Builsa, 30 in Bongo, 37 in Bawku East, 29 in Bawku West, 32 in Navrongo and 40 in Bolgatanga.

CAMEROON

Various striga control activities were carried out in Cameroon in 2002 viz. on-farm and on-station varietal trials, intercropping and rotation trials, community seed production and farmers' field days. These activities were carried out in several locations in two major ecologies viz. Northern Guinea savanna and Sudan savanna. A total of 721 farmers were reached for the various activities ; out of these 99 farmers were involved in on-farm demonstration of striga control technologies. This represents an advancement over previous years' trials for which demonstration involved less than 30 farmers in 10 villages. For the intercropping demonstration trials, cowpea was planted 3 weeks after planting maize and between maize rows. Fertilizer was applied only to the maize. Results of the varietal trials confirms the tolerance of the STR cultivars. For both the STR and local cultivars, grain yield was higher in the northern Guinea savanna (Table 4). In the northern Guinea savanna, average grain yield of the three STR cultivars tested in a total of 20 trials-gave 33% more grain yield than the local cultivar (CMS 8501). The average yield superiority of the three STR cultivars over the local check was higher (63%) in the Sudan savanna. Average number of emerged striga plants was consistently lower for the STR cultivars than the local check. This was 55% and 64% for the northern Guinea and Sudan savanna, respectively. These results demonstrate the effectiveness of STR cultivars to sustain yield under striga infestation as well as less support for striga growth and development.

The yield advantage of STR cultivars over the local maize cultivar was maintained under intercropping. This was 1.43 t/ha in the northern Guinea savanna and 1.14 in the Sudan savanna (Table 5). Cowpea yield averaged 456 kg/ha and 376 kg/ha in these ecologies, respectively. Although striga emergence on STR cultivars averaged 63% of the emergence on the local cultivar in the Sudan savanna, emergence

Table 4. **Average grain yield of three striga tolerant (STR) maize cultivars and a local check on striga-infested farmers' fields in northern Cameroon in 2002.**

Ecological zone	No. of trials	Cultivar	Maize grain yield[b]	Striga plants
			kgha^{-1}	no. ha^{-1}
Northern Guinea Savanna	20	STR[a]	3120 (133)	18727 (55)
		Local (CMS 8501)	2350 (100)	33800 (100)
Sudan Savanna	16	STR	2798 (163)	34803 (64)
		Local (CMS 8501)	1719 (100)	54060 (100)

[a]Values for the STR cultivar is the average of three cultivars viz. Cam Inb STR 1, STR-Y and Advanced NCRE.
[b]Values in parenthesis express yield and number of emerged striga plants as percentage of those for the local check.

Table 5. **Yield of components crops in intercropping trials aimed at striga control in northern Cameroon, 2002.**

Ecological zone	Cultivar	Grain yield	Maize grain yield[b]	Striga plants
		Maize[a]	Cowpea[b]	
		kgha^{-1}		no. ha^{-1}
Northern Guinea Savanna	STR	3907.7 (158)[c]		30386 (716)
	Local	2480.0 (100)		4240 (100)
	Cowpea	-	456	-
Sudan Savanna	STR	2900.7 (165)		38867 (63)
	Local	1757.0 (100)		62010 (100)
	Cowpea	-	376	-

[a]Values for the STR cultivar in the northern Guinea savanna is the average of the three best of the five cultivars used viz. Cam Inb STR 1, STR-Y and Across 97 TZL W ; Values for the STR cultivar in the Sudan savanna is the average of the three cultivars used viz. Cam Inb STR, Across 97 TZL-Y and STR-Y
[b]Cowpea yield is the average yield from all the farms in the ecological zone ; a total of 16 for the northern Guinea savanna and 7 for the Sudan savanna.
[c]Values in parenthesis express yield and number of emerged striga plants as percentage of those for the local check.

on the STR cultivars in northern Guinea savanna was several times more than the emergence on the local cultivar.

Three field days, involving a total of 293 farmers, were organized in 2002. The field days were conducted on demonstration plots and involved a total of 6 varieties. Farmers were asked to appraise the varieties for preference with respect to a host of traits. STR-Y was chosen by the farmer notwithstanding that it was not empirically the best cultivar in terms of grain yield.

Selected farmers were trained in seed production. A total of 6 farmers from 5 villages were involved. Three STR cultivars were produced viz. Advanced NCRE, Cam Inb STR and STR-Y. Plots used for the seed multiplication were striga-free and the area of land per farmer ranged between 0.25 and 0.50 ha. Plots were isolated from other maize fields and were well managed. Farmers received foundation seed of the STR cultivars as well as fertilizer. A quarter of the farmers' harvest was returned to the programme. This will be used to reach more farmers in 2003. A major advantage of farmers' involvement in producing the seeds of STR varieties is their ability to reach and sell their generated seeds to other farmers that may be difficult for the researchers to come in contact with. In addition, it holds the promise of sustainability. A total of 750 kg of the three STR cultivars was recovered by the programme from the community seed production activity (Table 6).

Table 6. **On-farm community seed multiplication of striga tolerant cultivars in northern Cameroon, 2002.**

Ecological zone	No. of farmers	Cultivar	Seed quality produced	Seed quantity returned to IRAD
			kg	
Northern Guinea savanna	2	Advanced NCRE	2075	350
	1	Cam Inb STR 1	1050	100
Sudan	1	Cam Inb STR 1	800	150
	1	STR-Y	1300	100
	1	Advanced NCRE	900	50

MALI

Mali commenced participation in the striga control programme in 2002, hence it was the first year for the country. On-farm varietal trials were conducted with the objective of identifying the best striga tolerant cultivar that could be promoted and used subsequently in intercropping or rotation trials with legumes. There was severe drought during the growing season. Consequently reliable data was collected and analyzed for 8 out of the 14 trials conducted. The three cultivars evaluated significantly out-performed the local check by between 176% and 203% (Table 7). The most promising yield performance was exibited by EVDT 97 STRC 1. Differences among the cultivars for emerged striga were not significant. Twelve (12) On-farm rotation and intercropping trials were conducted with for treatments each: TVX1850-01F, EVDT 97 STR C1, TVX 1850-01 F in Association with EVDT 97 STRC 1, and farmer variety. Similar to the on-farm variety trials, differences among treatments were significant for grain yield and not for striga count.

NIGERIA

Trials in Nigeria were conducted by two teams; one covered the forest-savanna transition zone and the southern Guinea savanna while the other covered the northern Guinea and the Sudan savanna. Activities in the forest-savanna transition zone and the southern Guinea savanna involved varietal trials in Mokwa under striga-infested and non-infested conditions and intercropping trials with groundnut in five locations of the two ecologies. On-farm trials in the northern Guinea and Sudan savanna was designed to demonstrate legume intercropping and the benefits of one and two years rotation with cowpea and soybean in Ungwa Shamaki.

In the varietal trial conducted at Mokwa, significant variation was found for grain yield in infested and non-infested plots. Hybrids 9022-13 and 105-1 STR showed the most outstanding performance under striga-infested and non-infested conditions (Table 8). Performance of these two cultivars was about 3.1 t/ha under infestation and ranged between 3.7 t/ha and 4.6 t/ha in striga-free conditions. In all, nine of the 14 cultivars evaluated produced more than 2 t/ha of grain under infestation. Two cultivars were compared to the farmers' practice in four of the five locations used for the intercropping demonstration trials in the forest-savanna transition and the southern Guinea. In the last location (Yandev), only Oba-Super 1 was com-

Table 7. **Performance of improved and local maize in a variety trial in Mali, 2002.**

Variety	Striga plants	Grain yield
	no. ha-1	kgha-1
Acr 94 TZE Comp 5-Y	2130	953.0
EVDT 97 STR 1	1910	1054.0
Dembanyuma	2950	826
Local	2310	469.8
LSD (0.05)	NS	306.0

Table 8. **Performance of maize hybrids under infested and non-infested conditions in Mokwa, Nigeria 2002.**

Hybrid	Grain yield		
	Infested	no-infested	Loss
	kgha-1	kgha-1	%
9914-59 STR	2096	3248	36.1
9925-51 STR	1906	3042	32.0
0106-5 STR	2020	2739	23.6
9925-49 STR	2478	3885	35.3
010-16 STR	2174	3409	33.4
0505-16 STR	2774	3565	22.0
8425-8 STR	1840	3275	47.6
0106-2 STR	1363	2125	32.8
0106-7 STR	1942	2636	26.9
0105-18 STR	2773	3963	29.3
105-1 STR	3105	3745	19.5
9022-13 STR (check)	3143	4640	32.8
8338-1 (Check)	482	1370	62.2
TZL Compl-C4 (Check)	2088	2785	26.8
SE	632.6	475.3	

pared with the farmers' practice. With the exception of the forest-savanna transition zone where grain yield of intercropped maize was about 500 kg higher per hectare for Acr 97 TZL Comp 1 compared to Oba Super 1, yields of Oba Super 1 and Acr 97 TZL Comp 1 were comparable (Table 9). Both cultivars consistently out yielded the farmers' practice across locations. Yield was highest at Minna for all the cultivars. With the exception of Yandev where the farmers's practice had more than twice the striga in the Oba Super 1-groundnut intercrop, no definite trend in striga emergence was observed.

In the northern Guinea savanna, intercropping maize with cowpea variety IT93K 452-1 reduced maize by 252 kg/ha (Table 10). However, a cowpea yield of 719 kg was obtained from intercropped plots. This cowpea yield represents 51% of the yield obtained for cowpea in sole plots. Yield of soybean in sole plots was higher (70%) than that of cowpea. This outstanding performance and the high market price for the former suggests a possible major role for soybean in striga control and poverty alleviation among farmers in the sub-region. Although the number of striga plants per plot was, in general, very low, the sole crop maize had more than twice the number of striga in the maize cowpea intercrop. Monetary returns to cropping was highest for the sole soybean crop, followed by the maize-cowpea intercrop, sole cowpea and sole maize (Table 11). The positive effect of one- and two-year rotation with legumes on maize can only be demonstrated in 2003 and 2004.

Community seed production was carried out for cowpea and soybean while the breeder at IAR multiplied the seed of ACR 97 TZL Comp 1-W. For the legumes, the project provided the seeds required for planting as well as other inputs such as fertilizers and insecticides while the farmers provided land and labour with the agreement that a third of the grain harvest will be relinquished to the project. In all, 919 kg of cowpea cultivar IT93K452-1 and 1038 kg of soybean cultivar TGX 1448-2 were recovered from the farmers (Table 12). About 1150 kg of ACR 97 TZL Comp 1-W was produced by the institute. These seeds will be used for the demonstration trials in 2003.

The survey carried out in northern Nigeria showed that average area under maize for 20 farmers was 3.9 ha per farmer in Soba (Northern Guinea savanna) compared to 2.6 ha per farmer for sorghum (Table 13). Area under under sorghum was however higher than area under maize in the southern Guinea savanna (1.7 ha per farmer to 1.1 ha per farmer, respectively) and in the Sudan savanna (2.8 ha per farmer to 1.3 ha per farmer, respectively). The provision of STR varieties to farmers in the ecologies where maize is coming behind sorghum is bound to give greater impetus to maize cultivation over sorghum. In these ecologies more striga plants were found on sorghum compared to maize (Table 14), confirming the observation that sorghum appears to be the major crop contributing to increased striga seeds in soils.

Table 9. **Maize performance in maize-groundnut intercrop in the forest-savanna transition zone and in the southern Guinea savanna in Nigeria, 2002.**

Zone	Location	Treatment	No. of striga	Grain yield
			no.ha^{-1}	kgha^{-1}
Forest savanna transition	Abeokuta	AbeokutaOba Super 1 + Groundnut	2911	1824
		Acr 97 TZL Comp 1-W + Groundnut	878	2368
		Farmers' practice	1678	1831
		SE	1173.2	260.0
Southern Guinea Mokwa		Oba Super 1 + Groundnut	597	1048
		Acr 97 TZL Comp 1-W + Groundnut	400	1342
		Farmers' practice	340	879
		SE	65.2	150.5
Southern Guinea Minna		Oba Super 1 + Groundnut	220	3628
		Acr 97 TZL Comp 1-W + Groundnut	254	3862
		Farmers' practice	653	2678
		SE	130.7	386.0
Southern Guinea Bida		Oba Super 1 + Groundnut	661	2142
		Acr 97 TZL Comp 1-W + Groundnut	183	2113
		Farmers' practice	589	1388
		SE	420.6	381.3
Southern Guinea Yandev		Oba Super 1 + Groundnut	4389	
		Farmers practice	3003	
		SE	10506	1404
			2226.3	743

Table 10. **Number of striga on maize and grain yield of maize and legume in sole and intercropped plots at Ungwa Shamaki, Nigeria in 2002.**

Treatment	No. of plants at harvest	Striga count		Maize grain yield	Grain yield of legume
		12 WAP	Harvest		
	no./plot			kg/ha	
ACR 97 TZL COMP 1-W (Sole maize)	410	12	23	1968.0	-
ACR 97 TZL Cowpea variety IT93K 452-1	437	4	11	1715.0	719.0
Sole Cowpea (IT93K 452-1)	424	-	-	-	1405.0
Sole Soybean (TGX 1448-2E)	-	-	-	-	2392.5
SE		1.43	1.75	16.18	

Table 11. **First year values of maize, cowpea and soybean in legume-maize intercropping and sole cropping aimed at rotation for striga control in Ungwa Shamakik, Nigeria, 2002.**

Treatment	Maize		Cowpea		Soybean		Total value
	Grain yield	Value at N20/kg	Seed yield	Value at N40/kg	Seed yield	Value at N36/kg	
	$Kgha^{-1}$	N	$Kgha^{-1}$	**N**	$Kgha^{-1}$	N	N
ACR97TZL Comp1-W (sole maize)	1968	39,360:00	-	-	-	-	36,360:00
TGX 1448-2E (sole soybean)	-	-	-	-	2392	86,130:00	86,130:00
IT93K452-1 (sole cowpea)	-	-	1405	56,200:00	-	-	56,200:00
ACR97TZL Comp1-W + IT93K452-1 (intercrop)	1716	34,320:00	719	28,720:00	-	-	36,040:00

Table 12. **Community based seed production of cowpea and soybean in northern Nigeria, 2002.**

Crop	Seed yield	Quantity recovered
	$kgha^{-1}$	kg
Cowpea (IT93K452-1)	2758	919
Soybean (TGX 1448-2E)	3114	1038

Table 13. **Farm size under sorghum and maize cultivation in 20 samples each of locations in three striga-endemic ecologies in Nigeria.**

Location[a]	Total farm size (ha)	Sorghum size	Maize farm size	Mean	
				Sorghum	Maize
Soba	103.9	51.3	77.7	2.6	3.9
Kachia/Z-Kataf/Jaba	72.1	32.9	21.4	1.7	1.1
Rano	136.4	71.1	33.72	3.6	1.7
Gwarzo	68.75	40.45	16.85	2.0	0.8
	381.15	195.75	149.67		

[a] Soba is in the northern Guinea savanna, Kachia/ Z. Kataf/Jaba are in the southern Guinea while Rano and Gwarzo are in the Sudan savanna.

Table 14. **Number of plants infested by striga and average number of striga plants per maize or sorghum stand in fields surveyed in northern Nigeria.**

Location[a]	**No. of plants infested by striga**		**Average no. of striga plants**	
	Maize	Sorghum	Maize	Sorghum
Soba	8	9	18	25
Kachia/Z-Kataf/Jaba	6	8	11	16
Rano	8	9	12	19
Gwarzo	5	8	4	13

Conclusions and Recommendations

In six countries of West and Central Africa (with the exception of Cote d'Ivoire), whose activities and achievements were presented in this report, scaling-up of striga control activities within the context of the Korean Government/ AU-SAFGRAD striga control initiative was, in general, vigorously pursued. The scaling-up was aimed at greater impact at farm level in countries of the sub-region, with desired goals of greater income for farmers, sustainable farm productivity and food security. The various activities, carried out in about 42 villages and which involved about 1268 farmers, included varietal trials to identify or confirm the most promising cultivars for particular locations or countries, demonstration of the effectiveness of legume intercropping and legume rotation with maize, community and research institute-based seed multiplication, farmers' field days and survey. Presentation of a few number of technologies with the greatest potential makes it easier for the farmers to reach a desision on the option that best suits them. The conclusions and recommendations from the activities of 2002 are as follows :

- The superiority of STR cultivars over the farmers' cultivar was evident across countries ; the extent of this superiority however depended on management and environmental conditions prevailing in the respective locations.

- The coverage of the trials was an improvement over those of previous year ; greater coverage can even be achieved in 2003.

- Improvement in yield following the cultivation of STR cultivars was often accomplished by reduced striga emergence, although such effect was not dramatic owing to several factors. Prominent among these factors are (i) the spacial variation in number of striga seeds in soils and (ii) the level of infestation in soils used for the demonstration trials.

- Farmers' field days were organized in some countries and not organized in others; all programmes need to incorporate field days in their activities and document such with pictures and video recordings. Field days, apart from being crucial in hel-ping farmers to make a decision of available technology, provided greater interaction among all stakeholders.

- The community seed production served to enhance community participation in the project, besides directly empowering farmers involved through sales of their seeds. The approach serves to ensure availability of adequate quantity of seeds for the following season.

- It was agreed on during the monitoring tour that impact can be greater through distribution of packs of about 1 kg of STR varieties to hundreds of farmers in striga-endemic regions. The community based seed production scheme will, no doubt, be very useful in this regard.

- Considerable improvement is required for on-farm demonstration activities in Mali and northern Guinea and Sudan savanna of Nigeria.

Appendix

Appendix 1.

Participants at the Striga Task Force Meeting of 4-5 April 2002 at the International Institute of Tropical Agriculture (IITA), Ibadan, Nigeria.

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Appendix 2.

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