ORGANIZATION OF AFRICAN UNITY

ORGANISATION DE L'UNITE AFRICAINE

SCIENTIFIC, TECHNICAL AND RESEARCH COMMISSION
COMMISSION SCIENTIFIQUE, TECHNIQUE ET
DE LA RECHERCHE

Semi – Arid Food Grain Research and Development
Recherche et Developpement des Cultures Vivrières dans les Zones Semi-Arides

Task Force Meeting Report on *Striga* Research and Control

4 - 5 March 1999
Abidjan, Côte d'Ivoire

Funded by the Government of the Republic of Korea through
the International Agricultural Research Institute (IARI)
of Kyungpook National University of Korea

and

The Organization of African Unity

through

The Semi-Arid Food Grain Research and
Development Agency (SAFGRAD) of the Scientific, Technical
and Research Commission of the OAU

Coordination Office / Bureau de Coordination
SAFGRAD
01 B.P. 1783, Ouagadougou 01 - Burkina Faso
Tél : 30-60-71/31-15-98
Fax : 31-15-86
Télex : 5381 BF

I. Opening session remarks

1.1 Opening remarks

A meeting of the *Striga* Task Force (STF) was held at Hotel Ibis in Abidjan, Côte d'Ivoire, March 4 - 5, 1999. The meeting was opened by the Chairman, Dr. Ngoupayou Ngou, Deputy Director General of the Agricultural Research and Development Institute of Cameroon (IRAD). A total of 18 participants from various organizations attended the STF Meeting (Annex 2.). The agenda (Annex 1.) was unanimously approved with one amendment: the paper on the 1997 On-farm *Striga* control testing sponsored by the International Agricultural Research Institute (IARI) of Korea was to be presented at 16:00 hours.

The International Coordinator of SAFGRAD welcomed and thanked participants for having accepted the invitation on short notice, to attend this very important meeting. It was stressed that next to soil fertility, *Striga* is the major food crop production constraint. Innovations need to be introduced to improve agricultural productivity based on new technologies. The consultant studies have shown that new and high performing technologies to control *Striga* do exist. These technologies, however, have yet to be adopted by farmers. Some of the missing activities to effectively control *Striga* are the lack of sensitization of farmers of the devastating effects of the parasitic weed on crop production, and articulation of the issue that control of *Striga* is also a gain in food security.

On behalf of OAU/STRC-SAFGRAD, the International Coordinator expressed deep appreciation to Prof. S.K. Kim for his contribution to the development of several maize cultivars tolerant and/or resistant not only to *Striga*, but also to streak virus while at IITA, for his continued support and dedication to *Striga* research, and for building the global awareness of the *Striga* problem in Africa, in particular, and among the scientific community in general.

1.2 Overview of the African *Striga* control cooperative program

Prof. S.K. Kim expressed to the STF group the willingness of the Government of Korea (GOK) and its IARI to help Africa boosts its grain production through *Striga* control. He acknowledged that due to the tremendous progress that has been made in *Striga* control research, maize yields can now be increased several fold. This gives an opportunity to farmers to increase their production and also generate revenue. He stressed that progress in *Striga* research has been obtained through the collaboration and cooperation he has received, as a maize scientist, from his highly dedicated Nigerian and Cameroonian colleagues. Finally, he underscored that the time has now come to introduce *Striga* control management to farmers and leave *Striga* research to IARCs and advanced NARES.

In a follow up discussion, the representative of the International Maize and Wheat Improvement Centre (CIMMYT) pointed out changes that have taken place in maize *Striga* control research over the last 5 years. The coordinator of the Pan-African *Striga*

Control Network (PASCON) expressed his full satisfaction with the involvement of the OAU/STRC-SAFGRAD in the coordination of the on-farm *Striga* control adaptive research in sub-Saharan Africa (SSA). This will complement the initiatives already taken by the networks, such as the West and Central Africa Maize Network (WECAMAN) and PASCON. Responding to a question on the basis for the selection of the crops, it was pointed out that owing to the limited resources, the program would focus only on maize based production systems. The program is a Pan-African one and covers several countries and crops to control *Striga* in SSA. During this meeting the STF will select the focal countries to participate in the project. Maize was selected because of limited funds and tremendous progress made in horizontal *Striga* resistance. This is in contrast with cowpea for which the focus has been vertical resistance. The project may be expanded to other crops in the future as more progress is made and funds become available.

II. The *Striga* Problem

2.1 The Consultant study report

The consultant's (Dr. N. Muleba) study underscored the massive food importation Africa will have to resort to in the year 2025 if nothing is done to increase agricultural productivity and production. The consultant outlined the objectives of the study mission as follows:

- To update the status of *Striga* research and control,
- To identify appropriate technologies, and then
- To propose mechanisms for institutional cooperation and arrangements that could speed up the exchange of scientific information and appropriate technologies between and within member countries.

The consultant study showed that crop yield losses due to *Striga* infestations vary from 30 to 40%. It was also apparent that areas with higher population densities were often associated with higher *Striga* infestations.

With regard to research findings for controlling *Striga*:

- The International Institute of Tropical Agriculture (IITA) research and those of advanced NARES have generated resistant or tolerant cultivars of maize and cowpea and agronomic practices including the use of nitrogen (N) fixing legume trap crop cultivars.

- The International Centre for Research in Agroforestry (ICRAF) has focused the use of short-term fallow of legume trees and shrubs such as *Sesbania sesban* and *Desmodium distortum* and the transfer of biomass and animal manure for improvement of soil fertility of infested fields.

- The International Centre for Insect Physiology and Ecology (ICIPE) has emphasized N-fixing legume cover crops such as *Desmodium uncinatum* that repel the maize stem borer insect pests while controlling *Striga hermontica* as trap crops.

- CIMMYT, in East and Southern Africa, has also identified improved maize: inbred lines, hybrids and synthetic populations resistant to *Striga*. They are in the pipeline and will be released soon. The use of acetolactate synthase (ALS) inhibiting herbicides that control *Striga* at very low rates is also emphasized.

Through agricultural research networks such as WECAMAN and PASCON some of the technologies have been transferred to NARES and to farmers in some countries. Nevertheless, the consultant study showed no evidence of either a large scale transfer and adoption of *Striga* control technologies or integrated *Striga* control measures in use by farmers in any of the countries visited. Based on these findings of the consultant study, the following activities aimed at speeding up the transfer of "integrated *Striga* control measures"were proposed:

- Strengthening the partnerships, among all stakeholders in *Striga* research and control;
- Establishing a *Striga* consultative group (SCG);
- Conducting on-farm adaptive research; and
- Undertaking on-farm training of farmers and extension workers in *Striga* management.

2.2 Overview of *Striga* research and control in some NARES

Except Benin, the consultant visited the following countries and institutions, which provided the following brief reports.

Benin

Striga research in Benin is done in collaboration with WECAMAN, the Pan-African *Striga* Control Network (PASCON), the Food and Agricultural Organization (FAO) of the United Nations, and the University of Wageningen in the Netherlands, stated Dr. G. Gualbert. Studies conducted in Benin to control *Striga hermontica* in cereal production have focused on farmers' traditional practices to control *Striga*; ecology of *Striga* germination; identification of *Striga* trap crops such as groundnut, soybean, cowpea and cotton and their respective best cultivars. Some cowpea cultivars were found to better control two different *Striga* species. Common practices used in *Striga* control are: early planting, intercropping, and plant density. Currently, emphasis is being put on testing and releasing *Striga* trap crops, particularly against *Striga gesneroides* parasitizing the cowpea crop. The development of integrated *Striga* management is being seriously considered. The transfer and adoption of *Striga* control technologies, as described above, have, however, been very slow.

Burkina Faso

In Burkina Faso, four crop commodity improvement programs: maize, sorghum, millet, and cowpea are devoting their research time and efforts in breeding for resistance against *S. hermontica* for cereals and *S. gesnerioides* for cowpea. Integrated *Striga* management is needed to achieve sustainable food crop production. Host plant resistance is not yet satisfactory for millet, sorghum, or rice. One millet cultivar, ICSV 1040 reduces *Striga* density; whereas sorghum cultivars, SR39, CES59 and Malisor have low yields but are resistant to *Striga*. Several cowpea cultivars resistant to *Striga*, such as Gorom local and Wangol, have been developed. Efforts are now being concentrated on the development of cowpea cultivars with good quality grains that are

high yielding and resistant to drought and heat stresses, *Striga*, major diseases and insect pests.

Post emergence herbicides have also been studied including for the control of *S. aspara* in paddy rice production. High performance liquid chromatography tests enabled the determination of the active ingredient in the pods of a legume tree, *Parkia biglobosa* that controls *S. hermontica*. The ingredient was found to be a strigol analogue. The biological control of *S. hermonthica* using the galling weevil insects, *Smicronix sp.*, and the ecology of these insects have been studied. The females lay eggs in ovaries when *Striga* is flowering; the eggs hatch while the ovaries undergo cell division subsequent to fecundation; and larvae feed on these cells and prevent capsule development and seed formation. *Striga* seed production can be reduced to as low as < 10%. The related research findings have been published in several international scientific agricultural journals.

With regards to the transfer and adoption of *Striga* control technologies, several cowpea cultivars have been adopted by farmers in *Striga* endemic areas of Burkina Faso, particularly in the northwestern regions. Cowpea being a cash crop, enables rural people and urban settlers to supplement their diet with cheap, good quality protein.

Cameroon

Dr. C. Thé informed the STF group about a huge *Striga* control program that Cameroon is about to implement. It consists of the development of field and laboratory facilities for screening and assessing germplasm for *Striga* resistance or as trap crops. A total of 29 ha of field facilities were set aside in 1998. Of these: 9 ha are free of *Striga* infestation, 6 ha are infested with *Striga* and will be used for screening and assessing germplasm for *Striga* resistance, another 6 ha infested with *Striga* will be used for *Striga* control using crop rotations including *Striga* trap crops, and finally 13.5 ha will be used for seed multiplication and maintenance.

This program's goal is to improve the efficiency in breeding for *Striga* resistance in Cameroon. To this effect, a strategy of combining laboratory chemical screening and field evaluation under artificial infestation will be used. For field evaluation under artificial infestation, 6 m long rows will be used; the first 3 m will be infested with 2-year-old *Striga* seeds at the rate of 1 kg *Striga* seeds for 50 kg maize seeds; NPK fertilizers will also be applied. The best-selected *Striga* resistant germplasm will be evaluated for their yield ability in *Striga* free plots.

Past experience has revealed that *Striga* resistant materials are also low yielding. That is why the new strategy described above was adopted to circumvent this negative association. Three best-inbred lines for different ecologies have been extracted. They are 88094, 87036, 9450.

Furthermore, agronomic practices showed satisfactory results in *Striga* control with the use of: organic matter such as cotton cake, brewery residue, pod residues of a legume tree, *Parkia biglobosa*; crop rotations including cereals with crotalaria, pigeon pea, mucuna, cotton, cowpea, soybean, groundnut, *Cassia obtufolia* (a legume cover crop), etc.

The Cameroon program is also involved in international trials, and was selected as a testing site for *Striga* resistance in the new African Maize Stress project managed by IITA/WECAMAN.

Côte d'Ivoire

The *Striga* problem in Côte d'Ivoire is confined to the regions north of the 8th parallel where maize is grown in association with legumes and in a rotation with cotton as confirmed by Dr. A. Koffi. Research is conducted in collaboration with IITA/ WECAMAN and CIMMYT. International and regional trials are regularly carried out in cooperation with these IARCs.

Currently, agricultural research is undergoing restructuration in Côte d'Ivoire. A *Striga* research team needs to be kept operational and equipped with field and laboratory facilities. Its research methodology is described as follows:

- Screening of local and introduced germplasm for *Striga* resistance;
- Studies of the genetic mechanisms of the resistant sources; and
- Introgression of the resistance genes into high yielding crop cultivars.

An agricultural scientist has been assigned the responsibility of technology transfer. He works very closely with the extension service in community seed production, marketing, and on-farm demonstrations of new technologies.

Kenya

Most *Striga* research in Kenya is conducted at the Kibos station in the Kisumu district. *Striga* attacks maize, sorghum, upland rice, fodder crops, sugar cane, etc. In Kenya, early maturing cultivars have smaller root systems, lower yield, and are less infested by *Striga* than the late maturing ones. The Pioneer Seed Company has developed maize hybrid cultivars resistant to acetolactate synthase (ALS) inhibiting herbicide. Modest application of ALS herbicide to these cultivars plus *Striga* hand pulling reduce yield losses due to the *Striga* parasitism.

On-going breeding work on *Striga* resistance is funded by the Rockefeller Foundation. The program uses two approaches: biotechnology and induced mutation to speed up the breeding and selection for *Striga* resistance. For the biotechnology approach, maize germplasm including the wild relative teosinte are screened for *Striga* resistance. Genes of resistant sources are mapped and markers developed for identification of resistance genes in segregating populations. The resistance genes are to be introgressed into good agronomic backgrounds, high yielding cultivars using Marker Assisted Selections (MAS). For induced mutation, some selected maize germplasm are exposed to mutagenic agents. Through this practice, different parts of the maize genome will undergo genetic changes that will hopefully create variability for resistance to *Striga*.

Satisfactory results have been obtained with improved short-term fallow. For example, a fallow of *Sesbania sesban* can reduce the *Striga* seedbank to 20% six months after its establishment. Maize yield doubles after 12 months of *S. Sesban* fallow. Trap crop experiments with N-fixing legumes have given very good results. And ethylene soil treatment was found to be very effective in controlling *Striga*. But its cost is beyond the reach of peasant Kenyan farmers. Therefore, the Kenyan *Striga* control research

program calls for integrated *Striga* control management, which can effectively control *Striga* and ensure sustainable food crop production.

2.3 Collaborative *Striga* research and control activities by IARCs.

IITA

The coordinator of the maize network for West and Central Africa, WECAMAN, (Dr. B.B. Apraku) presented the maize improvement program carried out by IITA at Bouake, Côte d'Ivoire, for early and extra-early maize cultivars. The main objective of the program is to combine resistance to drought, stem borer, and *S. hermontica.* To achieve this, the program is organized into four main activities:

i. Breeding for *Striga* resistance in early and extra-early maize cultivars, two populations each: white and yellow.

ii. Conversion of Pool-16DT, a drought tolerant cultivar, to *Striga* resistance.

iii. Conversion of the best extra-early cultivars, released in some countries, to *Striga* resistance; and

iv. Evaluation of *Striga* resistant maize cultivars under artificial *Striga* infestation.

The approach used consists of (a) crossing the base populations to the inbred *Striga* resistant line 1368, (b) crossing the resulting F1's to the base population, (c) selfing the backcrosses to S3 – S4's, (d) selecting suitable S3 or S4 lines under *Striga* infestation, and (v) recombining them to form synthetic populations. Synthetics so recombined are first evaluated in preliminary trials in Côte d'Ivoire and later on in regional trials. Since 1998, resistant maize cultivars have also been subjected to evaluations under artificial *Striga* infestation using 3 rows, 6 m long per entry. Only the first 3 m is infested with *Striga* seeds. Best resistant cultivars so far developed include TZEComp5-C5, Across 94TZE-Comp-5-y, and EVDT97STRC1.

It was, however, pointed out by one member of STF that this program relied excessively on a single inbred line as a source of *Striga* resistance. This could be hazardous, should some genes in this line be linked to deleterious genes. The sources of *Striga* resistance have been diversified in the new programs as discussed below.

Other *Striga* resistance research programs conducted at Bouake for intermediate maize maturity groups, and at IITA Ibadan, Nigeria, for intermediate and late maturity groups and mid altitude maize; and the use of a molecular biologist for mapping genes of *Striga* resistance sources that will serve as a tool in molecular assisted selections for speedy introgression of resistance genes in good agronomic background cultivars were also discussed. This is particularly important for the transfer of resistance genes from teosinte, *Zea diploperennis*, to maize. IITA has also developed a low *Striga* emergence pool at Ibadan and made substantial progress in *Striga* control.

CIMMYT

The CIMMYT maize improvement program in East Africa was presented by Dr. A.O. Diallo. In Kenya, CIMMYT is implementing the African Maize Stress (AMS) project. The stresses tackled include *Striga*, stem borer, N-use efficiency and to some extent drought. *Striga* is endemic in East Africa and cause more damage there than in West Africa. *Striga* density m^{-2} may reach up to >1000 shoots. The strategy used to develop resistant cultivars consisted of introducing the germplasm from more than 1000 inbred lines, screening them in heavily infested field plots under artificial infestation, identifying the resistant ones, diallel crossing them to form single cross hybrids, and evaluating the hybrids thus developed before recombining the best ones to produce synthetic populations. Through this exercise 105 lines were identified as *Striga* tolerant. Four of them yielded >1200 kg/ha against 282 kg/ha for the average population yield. Of the 112 hybrids obtained from the diallel crosses, 6 were better than the best commercial Pioneer hybrids under *Striga* infestation.

As part of the CIMMYT strategy for breeding for *Striga* resistance, two *Striga* screening sites have been identified in heavily, naturally infested areas: one at Alupe in the Kakamega district of Kenya and the other in Sudan. *Striga* evaluation sites have also been identified in Kenya, Sudan, and Tanzania. It was noted that the single cross hybrids developed by CIMMYT were still to be evaluated in multilocation trials. Open pollinated populations were to be synthesized based on the results of the evaluation of 212 top crosses out of which 9 yielded more than the best hybrids.

In East Africa, the altitude is > 1000 m above sea level in maize growing areas and the foliar disease *Helminthosporium turcicum* is endemic there. Any commercial maize cultivar must be resistant to this disease, or else it useless. Since *Striga* tolerance involves quantitative genes, as is the resistance to *H. turcicum*, backcrossing programs for the conversion of *Striga* resistant West African maize to *H. Turcicum*, resistance while keeping *Striga* resistance genes will be very laborious if not feasible. Also, because yields of hybrids are not greatly different from those of inbred lines under *Striga* infestation, the commercial production of hybrids might not be economically feasible unless it is combined with the use of good agronomic practices that will boost yields several fold. The CIMMYT/AMS project thinks that *Striga* resistant open pollinated maize populations will be the solution for boosting maize production in East Africa. It has a maize research network with *Striga* screening sites in Kenya and Sudan and evaluation sites in several member countries.

2.4 PASCON on-farm adaptive *Striga* control trials

Regardless of the problems encountered, the 1997 PASCON Trials funded through the Government of the Republic of Korea gave reliable data from Nigeria, Togo, Benin, Ghana, and Burkina Faso. This represented > 50% of the trials. In general, *Striga* resistant cultivars out-performed the best local cultivars. Open pollinated and hybrid maize cultivars did not differ much in their yielding abilities. Farmers were very appreciative of the new improved maize cultivars. The coordinator of PASCON network (Prof. Lagoke) finally advised NARES scientists that once an agreement has been reached for collaborative trials, participating countries should commit themselves to implementing the trials and reporting the results.

In a follow up discussion, Prof. Lagoke was informed by a member of the STF that the major problem encountered in carrying out the project was a lack of communication between Nigeria and other countries and the use of improper communication channels, (i.e., scientist to scientist and not institution to institution). Therefore, in the future, the coordinator of the project should communicate with research institutes of NARES member countries and inform them about the trials, the cost, and the commitment of the project to support the cost of the trials.

The participants were given a list of eight issues to reflect on overnight to be debated in two working sub-groups on March 5, 1999. One sub-group was to discuss technical matters and the other institutional cooperation and arrangements for the establishment of partnerships among participating NARES, IARCs, SAFGRAD, NGOs, etc.

III. Framework for *Striga* Research and Control Collaborative Program in Sub-Saharan Africa

The main objectives of this project are to enhance complementarities between IARCs and NARES. The project emphasizes the need to forge an active collaboration involving farmers, extension workers, merchants and suppliers of inputs, and policy makers for effective *Striga* control, which is conducive to increased agricultural productivity and production. Focal NARES benefitting from the project will be identified during this STF meeting. IARCs are expected to continue conducting basic and strategic research and to develop research methodologies, which NARES can use in the development of new technologies. IARCs partners in *Striga* control include IITA, CIMMYT, ICRISAT and others working in *Striga* control in SSA.

The project includes Operational Research, through which technologies will be assessed for their socio-economic feasibility. The technologies are comprised of resistant cultivars and agronomic practices, i.e., soil fertility improvement and minimal use of chemical fertilizers and pesticides. The project also promotes regional trials including on-farm validations and demonstrations of proven technologies ready for transfer to farmers. The African *Striga* control project will, thus, link IARCs to farmers through NARES. It will work with the maize network, WECAMAN, in West and Central Africa and the maize network ECAMAW managed by CIMMYT in East and Southern Africa. It will also promote the exchange of scientific information, materials, and technologies between West and Central Africa and East and Southern Africa. This will be achieved through monitoring tours, workshops, and scientific forums held under the project management.

The private sector, as a *Striga* control stakeholder, will be an integral part of the project. It will play an important role through seed increase and marketing and agricultural input supplies. The project will articulate production issues, bring together IARCs, NARES, farmers and other agencies promoting *Striga* control and food crop production. Attempts will be made to build awareness of the *Striga* problem. The project will also influence governments to consider *Striga* as a major constraint to food security.

Comments

This project was not conceived to compete with IARCs or any advanced NARES involved in technology development, evaluation and validation (stated Prof. S.K. Kim). Its main goal is to promote on-farm technology demonstrations and transfer for option by farmers. It should convince farmers to stop the continuous monocropping of cereal production and adopt a rotation of legume and cereal crops. It does not advocate the spraying or application of any chemical; but it emphasizes the use of an integrated pest management approach and encourages farmers to spend money for the purchase of seeds and any other critically needed agricultural inputs. In any case, the project spoils farmers by giving them seeds free of charge. The STF was urged to make the on-farm demonstration technology packages very simple and not confusing for the farmers. The project will, therefore, have to push technologies to farmers as quickly as possible. Based on satisfactory progress made and problems encountered, more funds can be secured to support *Striga* research and control technology development by IARCs and advanced NARES. For the time being, the Government of the Republic of Korea (GOK) provides a total funding of US$100,000.00 out of which US$20,000.00 are allocated to IARI of Korea for monitoring the project activities; and US$80,000.00 are committed to the project through OAU/STRC-SAFGRAD. The latter agency is also providing some funding support to the project. The overall cost of the project includes: the *Striga* Task Force meeting; seed increases; trial packaging and dispatch to NARES; trial monitoring tours; data collection, compilation and analysis; feedback and reporting of trial findings. The technical working group will debate related issues and make appropriate recommendations.

Finally, Prof. Kim added: participating countries should also contribute some funding to the project to show their commitment to *Striga* control. Otherwise the project should be immediately terminated. He also urged that if a country is not serious about combating *Striga* that it should refrain from participating in this project.

On behalf of IITA, the WECAMAN Coordinator stated the willingness to be involved in the project as opportunities are offered for transferring to the users several technologies IITA has developed to control *Striga*, improve soil fertility and supplement livestock with good quality forage. The same is true for WECAMAN. This maize network for West and Central Africa has 3 or 5 countries which have been assigned research responsibilities on *Striga* control and is also receiving funds from the African Maize Stress (AMS) project. Therefore, the *Striga* control on-farm adaptive research and demonstration project comes in support of the existing, on-going research activities. WECAMAN noted, however, that Senegal, the Gambia, Chad, and Guinea are not members of the *Striga* control project. Dr. B.B. Apraku ended his comments by stating that both IITA and WECAMAN are ready to work and collaborate in the logistics of preparing the trials for on-farm *Striga* control testing and demonstrations if the STF group asks them to do so.

The CIMMYT representative commented that a number of best inbred lines, resistant to *Striga* have just been identified. Out of them, 4 single cross hybrids and 2 synthetics have been made. The materials will have to be on-station evaluated under artificial *Striga* infestation in Ethiopia, Kenya, Tanzania, or Sudan. Next year, CIMMYT will be in a position to move the best selections on-farm testing. It is also keen to introduce new technologies for controlling *Striga* developed elsewhere for on station evaluation under artificial infestation before on-farm testing of the most promising ones is done. It has an

on-going activity testing cultural practices in Kenya and Tanzania. The contribution of the *Striga* control on-farm adaptive research and demonstrations will enable CIMMYT to expand its on-farm *Striga* control activities.

CIMMYT is also receiving funding from the AMS project. The maize stresses tackled under this project include: *Striga*, stem-borer, N-use efficiency, and other major disease epidemics. The CIMMYT maize network has nine on-station screening sites; out of which two are for *Striga* artificial infestation: one located in Kenya and the other in Sudan. CIMMYT also has 40 sites for evaluation of the most promising technologies, distributed throughout the ASARECA network member countries.

Finally, Dr. Diallo suggested to the group some criteria to be used for participating countries in the On-farm Adaptive *Striga* Control Project. One criterion is that technologies already exist in the country, therefore, on-farm adaptive research and demonstrations can be carried out. Another is: no proven technologies exist, therefore, steps should be taken for technology evaluation to be first effected on-station before transferring the most promising ones to farmers through on-farm demonstrations. Respecting these steps is crucial to avoid farmers rejecting technologies that have been demonstrated and the credibility problem such a rejection may raise!

For Cameroon, the "On-farm adaptive *Striga* control project" was welcomed as it helps Africa in its endeavor to solve food deficit and achieve food security. Prof. S.K. Kim was heartily thanked for his contribution as an advisor to NARES scientists and for his dedication to the development of maize *Striga*-tolerant cultivars during his 15 years at IITA; and, as an international agricultural research administrator, for securing funds and sponsoring sustainable food crop production in Africa. Suggestions were also made for some NARES to be involved in seed increase and packaging for on-farm trials and demonstrations. Since this project offers them an opportunity for moving new technologies to farmers. It was, however, recognized that NARES are not uniform. Some of them are more advanced and well equipped than others. But in any case, the project will benefit all of them and they are committed to its implementation and success.

The representative from Benin expressed the same views as the representative from Cameroon. He added that this project should intensify the interactions between NARES, particularly in seed production and trial packaging and dispatches.

For Burkina Faso, the "On-farm adaptive *Striga* control project" was welcomed since it focuses on cereal and grain legume crop productions and the transfer of appropriate technologies to farmers. Now that the OAU/STRC-SAFGRAD is the project facilitator, there is no doubt that NARES scientists will be committed more than ever before to the implementation and success of the project.

Because *Striga* research and control were initiated in Côte d'Ivoire only recently, i.e., about three years ago, and owing the re-structuration of agricultural research that country is undergoing now, Dr. A. Koffi stated that: the participation of Cote d'Ivoire in the "On-farm Adaptive *Striga* Control Project" will be a progressive one. This, to enable it to survey the country and identify the major *Striga* problem areas and proceed to the evaluation and validation of introduced technologies for the selection of the most

appropriate ones that deserve on-farm demonstrations. Only then can this country be a full partner in the project.

For Kenya, farmers are very familiar with the *Striga* problem. However, they do not consider it a major food crop production constraint deserving any research priority. Scientists will have to convince them that *Striga* infestation is a production constraint. To achieve this, scientists will have to interact strongly with extension workers and farmers in group discussions and on-farm testing and demonstrations. Farmers like to see impacts in the fields before considering changes. Since *Striga* control is a long-term project; to be successful, it needs persistent effort. Therefore, funding should not fall short during the long process; otherwise, there will not be any impact. For the subregion, there used to be an East African *Striga* control network. It started in 1993 and met in 1994 and 1996. It was funded by CIMMYT. East African scientists are now trying to revive it. Nationally, there is on-farm work going on in Kenya. The OAU/STRC-SAFGRAD funding is welcomed. It will enable Kenya to continue its on-farm *Striga* control testing for which funding is coming to an end next year. Training is also a necessity and Kenya needs information on how the Ghanian experience in training farmers may benefit it.

From the perspective of an African agricultural research administrator (Dr. N. Ngou), most funding done by donors so far, does not properly address the targeted groups; funded projects are not integrated in the on-going research programs; and as the funding comes to an end, the research activities also stop. With regard to the *"Striga* control project", one notes that sufficient technologies exist to alleviate the *Striga* constraint. But why has that not been done so far? To avoid the errors of the past, this project should examine carefully its components and identify the bottleneck that may impede its successful impact on food crop production. The project needs to emphasize interaction with farmers, extension workers, and both public and private agricultural development agencies. It should also encourage South-South cooperation and collaboration. This cooperation should be reflected in the budgets allocated to NARES.

Finally, the coordinator of PASCON was very gratified to note that NARES scientists participating in this STF meeting found the "On farm adaptive *Striga* control project" as an opportunity offered to them for transfering technologies to farmers. He underscored the variability of technologies from country to country and from region to region within a country. And proposed for the number of trials and participating farmers per country to be decided in this meeting. Plot size should be large enough to have an impact on farmers' decision making process; and farmers should be involved in planning and implementing the trials. The opening day should also be given due respect as it is critical for the success of the on-farm trials.

IV. Working Group Session

Two separate Working Group Sessions of the *Striga* Task Force were held. One group examined the institutional arrangements among NARES of participating countries and IARCs. And the other group discussed technical matters pertaining to on-farm adaptive *Striga* control demonstrations. After review and debate by the members of STF, the following recommendations were made.

V. *Recommendations*

5.1 *Realizing the importance of an active Striga Task Force (STF) for the success of the project, the functions and role of the STF were reviewed. They include the approval of on-farm adpative research and demonstration work-plans, monitoring and overseeing of their implementation, review of research findings, and the proposal of the necessary amendments conducive to the attainment of the project objectives.*

5.2 *Furthermore, it was recommended that the membership of STF include representatives (researchers and managers) from West, East, Central and Southern Africa, Seed Companies, NGOs, Global 2000, IARI of Korea and OAU/STRC-SAFGRAD.*

5.3 *Depending on the availability of funds, it was suggested that the STF should meet once a year or undertake monitoring research tours every other year.*

5.4 *To enhance complementarity and synergy for an effective Striga control project, a broader partnership including the following was suggested:*

i. *NARES whose crop production has been limited due to Striga infestation.*

ii. *IARCs and other research and development agencies engaged in Striga research and control such as IITA, CIMMYT, ICRISAT, ICIPE, ICRAF, etc.*

iii. *Collabrative research networks such as WECAMAN, ECAMAW, RENACO, and others for millet and sorghum in SSA.*

5.5 *Recognizing that policy makers and farmers themselves have not considered Striga as a major constraint reducing agricultural production; the STF, therefore, recommended technical and social activities--leading to increased awareness of farmers, decision makers, development agencies, etc. on the importance of controlling Striga to enhance the attainment of food security in SSA--be undertaken by the project. Technical on-farm demonstrations for controlling Striga combined with community group discussions are very powerful tools for increasing awareness of Striga problems.*

5.6 *With regards to the linkage and partnership in Striga research and control, the STF recommended that OAU/STRC-SAFGRAD contact NARS Directors of participating countries for them to appoint National Coordinators/Correspondants who will be responsible for the implementation of the On-farm adaptive Striga control project in their respective countries. While awaiting such nominations, the STF recommended that NARES scientists of*

countries that attended the STF meeting serve as Temporary National Coordinators. They are:

Benin	*G. Ghehounou*
Burkina Faso	*O. Ouedraogo*
Côte d'Ivoire	*A. Koffi*
Cameroon	*Charles Thé*
Nigeria	*S.T.O. Lagoke*
Kenya	*G. Odhiambo*

5.7 *With regards to the type and nature of on-farm adaptive Striga control trials and demonstrations, the STF suggested having flexibility in the choice of technologies by member countries based on their respective cropping systems. Four models were therefore proposed; each will include a control treatment, i.e., the farmer's current production technologies, viz., cultivars and agronomic practices. The plot size for each treatment will be 25 x 25 m.*

Model-1. *A three years' rotation consisting of three treatments rotated each year: (1) farmers practices; (2) Striga tolerant improved maize cultivar with NPK fertilizer; and (3) Striga tolerant improved maize cultivar intercropped with a N-fixing legume trap crop.*

Model-2. *Continuous cultivation of a Striga tolerant improved maize cultivar intercropped with a N-fixing legume trap crop tested against farmer's practices;*

Model-3. *A three years' rotation with three treatments rotated each year: (1) a N-fixing legume trap crop, (2) a cotton crop, and (3) a Striga tolerant improved maize cultivar.*

Model-4. *A two years' rotation with two treatments rotated each year: (1) a Striga tolerant improved maize cultivar, and (2) a cotton crop. The farmers' practices will be observed from a nearby field.*

5.8 *Based on the economic importance of maize, and the national capacity and comparative advantages to undertake Striga research, focal countries were identified and recommended by the STF for their participation in the Striga control project at this point in time. They include Benin, Burkina Faso, Cameroon, Côte d'Ivoire, Ghana, Nigeria, Mali, and Togo in West and Central Africa. Focal countries that were retained for on-farm testing and demonstration in East and Southern Africa include Kenya and Tanzania; for cultivar evaluation and validating trials, Ethiopia, Malawi, Uganda, and Zimbabwe.*

5.9 *With regards to the minimum sets of trials to be conducted per country, the following suggestions were made:*

- *Countries with no proven Striga resistant, tolerant or trap crop cultivars; and in compliance with the normal procedure for technology evaluation, validation and transfer; will have to proceed first with technology multilocation testing in*

experiment stations and on-farm testing under a scientist's supervision before proceeding with on-farm testing and demonstrations. This will represent, for countries with a monomodal rainfall pattern, a minimum of 2 years of technology introduction and testing before on-farm demonstrations.

- *Countries with proven Striga resistant, tolerant, and/or trap crop cultivars will proceed with on-farm demonstrations using one of the four models.*

- *For the sake of interpretation and easy comparison of results obtained in different countries, one Striga resistant improved maize cultivar: Oba-Super-1, will have to be included in one of the trials conducted by each member country. Other recommended cultivars include: for early maturity group: TZE-Comp-5-Y; intermediate and late maturity groups: STREC-WF and TZL-Comp-1C4.*

- *Each country will conduct a minimum of 3 to 5 trials with 5 to 10 farmers per village. An absolute minimum number of trials per country is 10 sets. This is to allow statistical analysis.*

- *With regards to the type of trials to be conducted and the number of sets to be used, each country will have to submit a proposal using the maize network WECAMAN format before April 5, 1999. The proposal will have to be addressed to Dr. T. Bezuneh for West and Central Africa, and Dr. A.O. Diallo for East Africa. It should describe treatments to be tested or demonstrated, plot size, number of trial sets, number of farmers per village, costs, etc. OAU/STRC-SAFGRAD will have to write to the Directors of Research of member countries about the commitment of funds for the implementation of the trials.*

VI. Seed preparation and funding

6.1 With regards to seed production packaging and dispatches of trials and elite germplasm, it is recommended that these activities be well streamlined. Furthermore, the following elite cultivars were recommended for:

i) West and Central Africa, common cultivars that can be used for on-farm testing or demonstration include: TZE-Comp-5-Y, STREV-WF, TZL-Comp-1C4, Oba-super-I, and Oba-Super-II. Their seeds will be supplied by IITA as well as by WECAMAN. For other maize cultivars, their seeds will have to be specifically requested from either IITA or WECAMAN.

ii) East and Southern Africa, seeds of cultivar KSTP-94 for on-farm demonstrations in Kenya and Tanzania, and other cultivars for varietal testing will have to be supplied by the CIMMYT/AMS project based in Nairobi, Kenya.

6.2 With regards to seed needs and fund allocation per country, recommendations are as follows:

i. A minimum of 10 sets per trial per country, which requires about 75 kg of seed per country.

ii. Total funding of four thousand dollars ($4,000.00) per country covering all costs:
- this should be described in the project proposal.

The STF also discussed the possibilities for establishing a *Striga* Consultative Group (SCG) or an African *Striga* Consortium (ASC). Since such an initiative would be useful, OAU/STRC-SAFGRAD was encouraged to look into the possibilities for creating one of these groups.

Annex 1.

Agenda

Thursday, 4 March 1999

09:00 - 09:30	Opening remarks: Dr. T. Bezuneh
09:30 - 10:00	Overview of Africa *Striga* control cooperative program: Prof. S.K. Kim
10:00 - 10:20	Comments and discussions
10:20 - 10:35	Break
10:35 - 11:05	Consultant report
11:05 - 11:20	Comments and discussions
11:20 - 12:35	Overview of *Striga* research and control in some NARES: Cameroon, Benin, Burkina Faso, Côte d'Ivoire and Kenya.
12:35 - 13:00	Comments and discussions
13:00 - 14:30	Lunch break
14:30 - 16:00	Collaborative *Striga* research and control activities by IITA/WECAMAN, CIMMYT/AMS project and ICRISAT in West and Central Africa.
16:00 - 16:20	Comments and discussions
16:20 - 16:35	Break
16:35 - 17:20	What to do next. List of issues

Friday 5 March 1999

08:30 - 10:30	Framework for *Striga* research and control collaborative program in sub-Saharan Africa. Program options, comments.
10:30 - 10:45	Break
10:45 - 12:40	Working groups session: (i) Technical, (ii) Institutional
12:40 - 14:30	Lunch break
16:00 - 14:30	Rapporteur reports for technical working group, rapporteur reports for Institutional Working group. Discussions and recommendations.

Annex 2.

Opening Remarks

By

The International Coordinator
OAU/STRC-SAFGRAD

I take this opportunity to welcome you to this important *Striga* Task Force Meeting.

As you know, the majority of rural populations in Africa heavily depend on agriculture as a source of employment and income. Various studies including that of the World Bank show that 4 per cent agricultural growth is the bottom line to sustain food security, to end hunger and malnutrition.

At the eve of the 21st century, science based innovative agriculture is the way out to enhance growth in agriculture, to generate income and employment and eventually improve the livelihood of millions of households in sub-Saharan Africa (SSA).

There is a need for a new research and development approach to alleviate the major socio-economic and technical constraints in order to enhance agricultural growth.

Regardless of the impressive *Striga* research and control efforts involving NARS, farmers, NGOs, IARCs, extension/or government efforts, *Striga* remains one of the biological constraints (next to soil fertility) that is known to substantially reduce crop yields.

Although some progress has been made in the development of *Striga* tolerant to resistant cultivars, for example, maize, sorghum, cowpea, millets, etc. its damage on crops and the resulting yield losses have increased all agro-ecosystems in sub-Saharan Africa. Thus, the control of *Striga* is more complex than that what has been understood.

The main objectives of the collaborative program between the Republic of Korea through its International Agricultural Research Institute (IARI) and the Organization of African Unity through SAFGRAD, is to enhance complementarities among partner institutions and farmers engaged in *Striga* research and control. This continental program serves as a forum for exchange of technical information, as well as to articulate policy issues and to build awareness from community to government levels to facilitate support for research and control of *Striga*.

The consultant study indicates the evidence of research thrust to control *Striga* throughout sub-Saharan Africa.

Among the less emphasized missing links of *Striga* research and control activities are:

i) Building awareness among farmers, research managers, policy makers and the community at large of the importance to control Striga to minimize its damage to crop yield that accrues to several millions tons per year.

ii) Articulation of the link between *Striga* control and food security.

iii) Systematic on-farm adaptive evaluation of integrated *Striga* control packages of technology at focal countries in SSA.

This *Striga* Task Force (STF) meeting is expected to address the following issues:

1) To review the current state of *Striga* research and cooperation, then, identify the missing technical and institutional links, and to put in place efficient mechanisms for *Striga* control technology transfer.

2) To define partner institutions and their specific roles for enhancing *Striga* research and control.

3) To define the composition and function of the *Striga* Task Force.

4) Based on research cooperative advantages of NARS, to identify focal countries that will participate in the program (from West, East and Southern Africa).

5) Taking into consideration NARS and IARCs on-going *Striga* regional trials, identify the level and nature of intervention and linkages of this cooperative program.

6) To discuss the proposed vision for establishing the *Striga* Consultative Group that may evolve into a Continental Consortium for *Striga* Research and Control.

On-behalf of OAU/STRC, I take this opportunity to thank the people and Government of the Republic of Korea and the Organization of African Unity for their financial support of this collaborative program. We would also like to underscore our deep appreciation to Dr. S.K. Kim, first, for his contribution in developing several maize cultivars and hybrids tolerant/or resistant to *Striga* while at IITA; second, for his continuous support and dedication to *Striga* research and control in Africa; and third, for the key role he has continued to play in building global awareness at the level of the scientific community and governments for the need to support *Striga* research and control in order to enable countries in SSA to attain food security.

Annex 3.

Overview of Africa *Striga* Control Cooperative Program

by

Prof. Soon-Kwon Kim, Director General,
International Agricultural Research Institute,
Kyungpook National University, Taegu, the Republic of Korea

I came here to help you as a former expert of striga controlling research and now a representative of a small donor country. The key objective of this striga control cooperative program is to increase grain production in Africa through the adoption of a new innovative striga control package that has been developed by multidisciplinary scientists from international agricultural research centers, advanced institutions and national programs in Africa and the world for the last half century. This cooperative program will certainly increase income of farmers in Africa in a sustainable way through the employment of grain production in a way of cereal and legume intercropping. The intercropping can increase or sustain soil productivity and reduce striga seed population in infected lands.

Farmers in Africa must consider their farming as a small business, not just a family surviving operation. Higher income can be generated by the adoption of the new technology. The key of the cereal production farming must be 1) choice of a right cereal cultivar that offer combined tolerance and horizontal resistance (co-survival mechanism) to the major biotic stresses (not just striga tolerance alone), 2) high/sustainable yield potential under Africa's local environments, and 3) cropping of market demanded crops that extra grain can be sold.

I as the multidisplinary research team member of IITA conducted very intensive striga resistance breeding work during 1982 and 1995 with about over 10 ha, annually, of artifially infested striga fields at Mokwa, Abuja, Bagauda (collaborate with ICRISAT), Jos, and Abeokuta (collaborate with Ogun ADP). The breeding operation was regarded the largest striga resistance research in the world with over 10,000 lines, families, hybrids and open-pollinated cultivars tested annually. Coperative works also carried out in Zaria, Nigeria (collaboration with Prof. Lagoke), Garoua (collaboration with Drs. The and Talleyrand), and Ferke (collaboration with Drs. Fajemisin and Badu-Apraku). After I left IITA at the end of 1995, Dr. J. Kling has been in charge of IITA striga resistance breeding works and apprently has done outstanding work. Similar research works have carried out by breeders and other disciplinary scientists at IITA (maize and cowpea), CIMMYT (maize), ICRISAT (sorgum and millet), ICRAF (short term fallow, soil fertility improvement), ICIPE (pull-push strategy) and national programs. Based on results of striga research obtained so far, the worst parasitic weed can be controlled in a sustainable way through the adoption of tolerant cereal crop with legume intercropping. The results of IITA striga biologist works showed that N-fixing legume can suppress striga germination to the adjuscent cereal plant, giving a direct suppressiveness of striga germination. This gives cereal + legume intercropping is better than the cereal + legume rotation. Tolerance of a cultivar is controlled by quantitatively inherited resistance genes and that can be called as horizontal resistance or partial resistance in disease and insect resistance terms. In parasitic weed resistance terminology with only low emergence of parastic weed plants is considered wrong and this mis-use of terminology has misled sustainable and durable resistance breeding against parasitic weeds internationally.

IITA socio-economic research team found that striga problem is associated with the densly populated regions. Contineous cultivation of monocrop cereal-cereal cultivation depletes soil nutrition and invites striga problem and now both low soil fertility and striga problem made resource-ppor Africa's farming

situations be much worse than before. In this area, high yield potential cereal cultivar must be introduced. Striga, diseases, insect and drought tolerance hybrid cultivar with a high yield potential and stability to biotic and abiotic stresses will give a room for legume crop introduction. Beside the legume, lifestock raising can produce manure and compost that also improves soil fertility. Farmers and scientists as well as administrators and board members at the international centers work in Africa must understand that farmers in USA, Europe and Asia do produce cereal crops including maize and sorghum only under the condition of cereal -legume rotation and heavy input of farm yard manure, plus fertilizers.

Production of high quality seeds through seed companies must be encouraged by international centers, donor countries and new NGOs. This could lead only a sustainable Africa development by Africa initiatives. Privatization is known to be the best option for development and Africa should not be a special region for the world-wide economic development. African farmers must invest their own money to buy high quality seeds just like buy beers and coke and adopt the new technology. Each national program must give the top policy support for sustainable agricultural development and adoption of new technology regardless of where this technology generated.

IARC centers and donor countries in collaboration with Africa national programs have done tremendous works for Africa. However, majority of farmers in Africa want to get free-seeds and free-technology without any payback. The unsustainable and non-economic research and extension operations should be stopped by IARCsand international efforts must be made in economic and self sustainable way. The international centers would be better to produce breeder seeds only. Foundation and certified seeds must be produced by seed companies and national seed operations. The seeds must be sold to farmers and the seed production agencies must recover their investments and earn even small interest.

Recommendations

I do not like to discourage IARCs and NARSs good and outstanding research efforts that have done for Africa. Based on you and my experiences as well as literature reviews in research of parasitic weeds in Africa and other parts of the world, my recommendations are as follows:

- Technologies for cotrolling striga are available. Sustantial yield increases can be achieved if these technologies are extended to, adopted and effectively used by farmers. I heard similar view from IITA's DDG during my visit and this view is the same as the consultant's Dr. Muleba's report to this cooperative project.

- Continuous research should be done by IARC centers, advanced institutions in collaboration with national research and extension programs to find out better control package.

- Cereal crop cultivars with combined horizontal resistance to striga and major other biotic (e.g., maize streak virus, downy mildew, *Bipolaris maydis* -for lowland and *Exserohilum turcicum*-midaltitude) and abiotic stresses (drought and low nitrogen soil) must be intercropped with N-fixing legume(s) for sustaiable cereal and legume grain production.

- High quality seeds of cultivars with high and stable yield potential must be produced by seed companies and national seed services.

- The proven technology (horizontal resistance cereal crop cultivars + N-fixing and striga seed suppression legume intercropping) of research results published already in internationally well-known scientific journals such as Crop Science, Agronomy in USA, Crop Protection, Integrated Pest Management Reviews, International Journal for Pest Management in UK, Plant Breeding in Germany and Maydica in Italy etc. must be transferred timely to poor and badly needed farmers of striga infested lands in Africa.

Annex 4.

Framework for *Striga* Research and Control Collaborative Program in sub-Saharan Africa

By

The International Coordinator
OAU/STRC-SAFGRAD

The purpose of this program is to enhance complementarity and synergy among NARES, IARCs and other institutions engaged in *Striga* research and control. This program attempts to forage functional linkages on *Striga* research and control involving:

1.0 Focal NARES

National Agricultural Research and Extension Systems. Similar to other development activities, the effective control of *Striga* in several countries can lead to economic impacts and social benefits. No single country in sub-Saharan Africa has the scientific capabilities and resources to effectively control infestation of *Striga*. As population growth and degradation of the soil fertility increases, so does the infestation and damage of *Striga* in reduction of crop yields. At national level, this program promotes the participation of farmers with multidisciplinary research teams engaged for improving agricultural production and productivity.

Focal NARES that will participate in this program at sub-regional levels are :

i) West and Central Africa: Benin, Burkina Faso, Cameroon, Côte d'Ivoire, Ghana, Mali, Nigeria and Togo.

ii) Eastern Africa: Ethiopia, Kenya and Tanzania.

iii) Southern Africa: Malawi and Zimbabwe.

2.0 The International Agricultural Research Centres

The International Agricultural Research Centres are key players in basic and strategic research for developing *Striga* control . The important partners institutions include:

i) The International Institute of Tropical Agriculture (IITA)

The emphasis on maize research covers :

- *Striga* biology and control.
- *Striga* research and control in the most savannah.
- *Striga* research and control humid- lowlands.
- Grain legume *Striga* research and control.
- WECAMAN *Striga* research and technology transfer activities.

ii) The International Crop Research Institutes for Semi-Arid Tropics. (ICRISAT)

- Sorghum *Striga* research and control based in Mali.
- Millet *Striga* research and control based at Sadore, Niger.

iv) The International Maize and Wheat Improvement Program (CIMMYT)

- Strategic and applied research to control *Striga* in Eastern and Southern Africa.
- Facilitation of regional trials.

v) International Centre for Research in Agroforestry (ICRAF)

- Agronomic practices using trap crops and rotation.

vi) International Centre of Insect Physiology and Ecology (ICIPE)
Developing strategies for habitat management for reducing incidence of insects pests including *Striga* in food production.

Program :

(1) Operational Research (OR)

Technological options to be tested by Focal NARES will be identified from national, and regional sources such as networks. To control Striga, low to medium input requiring technologies will be identified. Technologies for controlling *Striga* will be assessed for their agronomic productivity, socio-economic feasibility and environemental friendlyness.

The main thrust of operational research activities will include :

i) Evaluation of *Striga* resistant/tolerant elite cultivars at Focal NARES.

ii) Development of appropriate cereal/legume rotation/intercropping systems (i.e. trap crops for rotation and improved agronomic practices).

iii) Soil fertility improvement (both organic and organic sources of fertilizer).

iv) Minimal use of chemical control (herbicides and seed treatment)

v) Promotion of regional trials.

3.0 On-farm Verification Trials

The project addresses one of the most crucial challenges facing Africa, i.e., attaining food security. Food grains are the major staple crops for millions of people in Africa. Next to soil fertility related problems *Striga,* is the major biological constraint that increasingly threatens the production of cereals. This project links innovative approaches to overcome the problem. First, technologies that are identified through operational research would be further verified and validated at on-farm level by the researchers. Second, farmers will be trained to carry out on-farm demonstration trials at village level using the IPM methodology. And third, the short term objectives of the on-farm verification trials is to package technologies for an integrated *Striga* control on maize, sorghum, cowpea and millets.

4.0 Regional Trials Linkages

The on-going *Striga* research and control regional activities are coordinated by IITA for the maize and cowpea networks in West and Central Africa; CIMMYT for the NARES in Eastern and Southern Africa ; and ICRISAT on sorghum and millets involving the sorghum network in West and central Africa and though its regional programs based in Nairobi, Kenya and in Zimbabwe.

This program support will enable FOCAL NARES to undertake on-farm Adaptive Striga ControlTrials, using the elite cultivars evaluated through regional trials or developed and screened by NARES themselves.

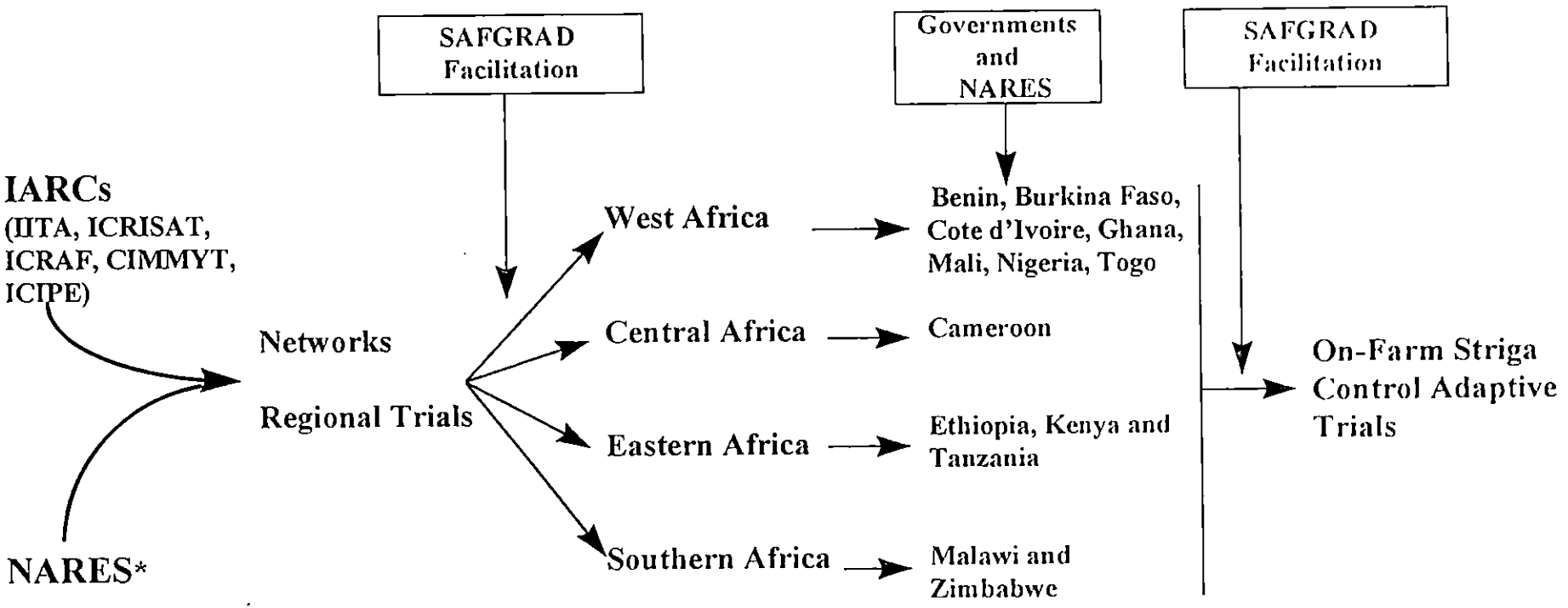
In West and Central Africa, this program will, therefore, closely work with maize network to implement an integrated *Striga* control management program. Similarly, in Eastern and Southern Africa, collaboration with CIMMYT and other appropriate organizations will be strengthened to implement trials.

5.0 Facilitating the flow and exchange of elite *Striga* resistant cultivars between sub-regions.

OAU/STRC-SAFGRAD will facilitate occasional workshops, monitoring tours of limited participants, exchange of reports and technical information and deliberations of the *Striga* Task Force which can lead to exchange of elite *Striga* resistant cultivars and related technologies between West and East and Central Africa ; as well as between Central Africa and other regions.

6.0 The Private Sector and NGOs

Seed increase is an important component to enhance technology transfer for increased agricultural production. Contacts with commercial seed producers and farmers cooperatives will be sustained.



Collaborative linkages for enhancing on-farm Striga control adaptive trials

*NARES: National Agricultural Research and Extension System

Annex 5.

List of Participants

BENIN

Dr. Gualbert Ghehounou
Chercheur
Malherbologiste
Institut National des Recherches
Agricoles du Bénin (INRAB)
INRAB/LDC
BP 128
Porto-Novo, République du Bénin

Telephone : (229) 21 29 33
Fax : (229) 30 67 36
Email : LDCSTRIG@BOW.INTNET.BJ

BURKINA FASO

Dr. Taye Bezuneh
Coordinateur International
OUA/CSTR-SAFGRAD
01 BP 1783
Ouagadougou 01 – Burkina Faso

Telephone : (226) 30 60 71/31 15 98
Fax : (226) 31 15 86
Email : oua.cstr@cenatrin.bf

Dr. Nyanguila Muleba
Consultant
OUA/CSTR-SAFGRAD
01 BP 1783
Ouagadougou 01 – Burkina Faso

Telephone : (226) 30 60 71/31 15 98
Fax : (226) 31 15 86
Email : oua.cstr@cenatrin.bf

Dr. Mahama Ouedraogo
Chercheur
OUA/CSTR-SAFGRAD
01 BP 1783
Ouagadougou 01 – Burkina Faso

Telephone : (226) 30 60 71/31 15 98
Fax : (226) 31 15 86
Email : oua.cstr@cenatrin.bf

Dr. Oumar Ouedraogo
Chercheur
Biologie/Physiologie des
Phanérogames Parasites
INERA
01 BP 476
Ouagadougou 01 – Burkina Faso

Telephone : (226) 31 92 02-08
Fax : (226) 34 02 71
Email: INERA.DIRECTION@FASONET

CAMEROON

Ngou Ngouyapou Jean Daniel
Deputy Director General and
Scientific Director
Agronome Zootechnicien
Agricultural Research Management
Institute of Agricultural Research
For Development (IRAD)
P.O. Box 2123
Yaounde, Republic of Cameroon

Telephone : (237) 22 33 62/23 35 38
Fax : (237) 22 33 62 23 38
Email : iradpnva@iccnet.cm

Charles The
Maize Breeder
IRAD
P.O. Box 2123
Yaounde, Republic of Cameroon

Telephone: (237) 22-30-22/22 30 22
Fax: (237) 22 35 38
Email: iradpnva@iccnet.com

COTE D'IVOIRE

Baffour Badu-Apraku
WECAMAN Coordinator
Plant Breeding Genetics
IITA
C/o ADRAO
BP 2551
Bouake, Côte d'Ivoire

Telephone : (225) 63 45 14
Fax : (225) 63 47 14
Email : B. Badu-apraku@ccgnet.com

Koffi Attiey
Chef du Programme Maïs
Génétique et Amélioration des Plantes
CNRA/IDESSA
01 BP 633
Bouake 01, Côte d'Ivoire

Telephone : (225) 63 51 22
Fax : (225) 63 68 53
Email : B. Badu-apraku@ccgnet.com

KENYA

George Duncan Odhiambo
National Striga Research
Technical Coordinator
Agronomist
Kenya Agricultural Research Institute (KARI)
NSRC-KIBOS
P.O. Box 1221
Kisumu, Kenya

Telephone : 254 2 2 296/43
Fax : 254 2 21296
Email : aoswald@net2000ke.com

NIGERIA

S.T.O. Lagoke
Striga Scientist
Coordinator, PASCON
Weed Scientist
IAR/ABU
Department of Agronomy
PMB 1044
Samaru, Zaria

Telephone : 234 69 50598 ;
Fax : 234 69 50563
Email : stlagoke@abu.edu.ng0ke.com

INTERNATIONAL ORGANIZATIONS/
ORGANIZATIONS INTERNATIONAL

Prof. Soon Kwon Kim
Director General
Maize Breeder
International Agricultural Research Institute
Kyungpook National University
Taegu, South Korea

Telephone : 82 53 950 670
Fax : 82 53 950 6778
Email : kimsk@bh.kyungpook.ac.kr

Dr. A.O. Diallo
CIMMYT Regional Breeder
Coordinator East Africa
Maize Breeder
CIMMYT NAIROBI
P.O. Box 25171
Nairobi, Kenya

Telephone : 254 2 52 14 50/57 64 14
Fax :
Email : A.O.DIALLO@CGIAR.ORG

1999-03

Task Force Meeting Report on Striga Research and Control

OUA/CSTR-SAFGRAD

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