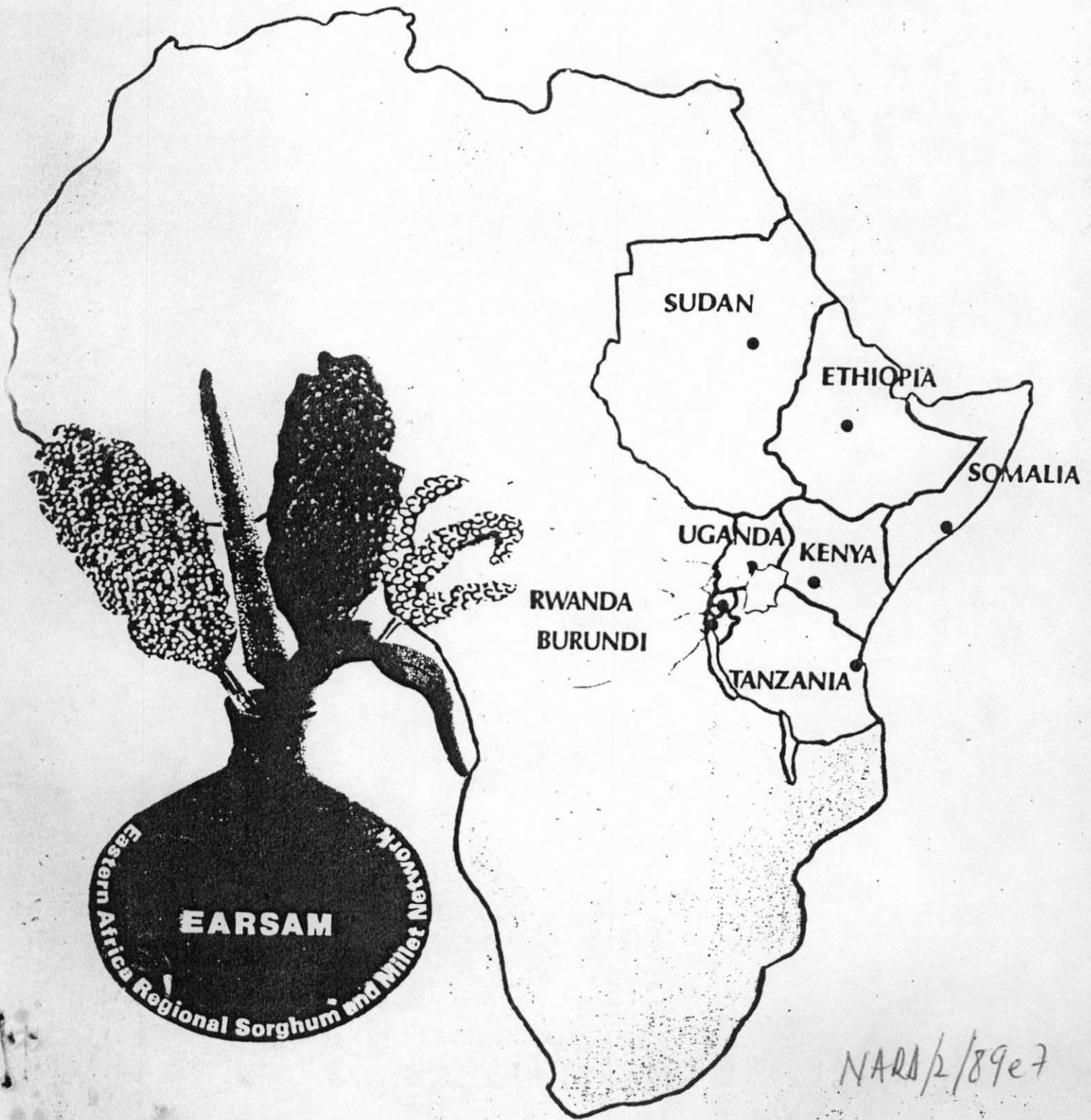


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Annex III EARSAM NETWORK ACTIVITY EVALUATION BY STEERING COMMITTEE

1986 TO 1988



NARA/2/89e7

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EARSAM NETWORK ACTIVITY EVALUATION BY STEERING COMMITTEE

1986 TO 1988

INTRODUCTION

The Eastern African Regional Sorghum and Millets (EARSAM) network, a project of the Semi-Arid Grains Research and Development Project (SAFGRAD), includes eight countries - Burundi, Ethiopia, Kenya, Rwanda, Tanzania, Somalia, Sudan and Uganda. EARSAM is a response to the growing concern in eastern Africa that food production is not keeping pace with population growth. Shortages of basic foods have become commonplace, and the region is now a net importer of food grains. Increases in food production will have to come from improved cultivars and improved farming practices.

Sorghum is the first or second-most important cereal in most of the countries of the region (see Table 1). Sorghum and millets are grown on marginal agricultural land where the cereals - maize, wheat and rice - do not consistently produce a reasonable harvest. The principal millet grown in the region is finger millet (Eleusine) while pearl millet (Pennisetum americanum) is mainly grown in the Sudan, eastern Kenya and central Tanzania in harsh conditions with less than 500 mm. rainfall annually.

Research priorities are to develop sorghum and millet cultivars with high and stable yields, with genetic resistance to biotic and abiotic stresses. Cultivars with these traits developed at the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) center in India and other places have been introduced into the regional program for further improvement by incorporating the traits into the local land races. Therefore, the challenge for the future is enormous. We believe that SAFGRAD/ICRISAT's efforts in the EARSAM network will better equip the region to deal with some of these challenges.

Sorghum production constraints

1. Low yielding varieties
2. Pests
3. Diseases

Varietal improvement
Stem borer (chilo), shootfly,
storage pests and birds
Ergot, grain mold, anthracnose,
charcoal rot and striga

4. Grain quality	Food products and brewing
5. Environmental stress	Drought and stand establishment
6. Agronomy	Soil fertility and soil

Millet production constraints

1. Plant improvement	Varietal improvement
2. Pests	Birds
3. Diseases (pearl)	Ergot (pearl millet), smuts millet and head blast (finger millet)
4. Grain quality	Food products and brewing
5. Environmental stress	Drought and stand establishment
6. Agronomy	Soil fertility and soil management

Acreage and production statistics of sorghum and millets are presented in Annex I.

EARSAM's objectives are:

1. To improve the production of sorghum and millets, thereby contributing to stabilizing food supplies in the region, leading to improved nutrition and income for the farmers in drier areas.
2. To assist and strengthen national sorghum and millet programs in the semi-arid zones of eastern Africa.

These objectives are achieved by:

- 1) Developing improved varieties and hybrids with the required pests resistance along with agronomic practices that will result in higher and more stable economic yields in the semi-arid environments.
- 2) Organizing and promoting systematic regional testing of available elite genotypes and technologies generated mainly by NARS (National Agricultural Research Systems) in the region or ICRISAT in all important ecological zones.
- 3) Identifying strong national programs to take lead in particular areas of collaborative research projects which are of regional significance.

- 4) Assisting in training and manpower development.
- 5) Providing research supplies and facilities needed to upgrade research capabilities.
- 6) Organizing regional workshops and monitoring tours in order to report research findings, to interchange ideas and breeding materials, and to foster closer national program cooperation.

Historical background of the regional network

Phase I : Since 1982, SAFGRAD, through ICRISAT, has made remarkable progress in training scientists from national programs. It has succeeded in bringing together various national programs through scientist to scientist interaction during regional workshops and field tours. As a result of these interactions, scientists have shared their research results, exchanged germplasm, and evaluated their elite genotypes on a regional basis with the help of the regional coordinator. Thus, Phase I activities from 1982 to 1985 established the groundwork for Phase II.

Phase II - 1986 to 1991 : A further effort was needed in 1986 to expand and strengthen sorghum and millet research in Eastern Africa by developing a strong and efficient networking model. This model was designed in such a way to further strengthen the ties among the NARS of the region not only interchange of scientific results, experiences and germplasms, but to share responsibilities on common problems in the region in order to avoid duplication of efforts. Thus, the following ideas were developed during the fifth regional workshop in Bujumbura, Burundi, July 5-12, 1986:

1. The formation of the Steering Committee represented by NARS to provide overall guidance for the networking activities.
2. The regional network model was developed and was given an identity and such an identity evolved in the form of EARSAM (Eastern Africa Regional Sorghum and Millet) network.
3. The Steering Committee members endorsed the previously identified common priority areas of research and developed collaborative research projects with ICRISAT through the regional coordinator.

This report, prepared by the Steering Committee members provides a review of the EARSAM Network activities from 1986 to 1988 and the future research strategies.

EARSAM RESEARCH ACTIVITIES

A. Collaborative research projects with NARS

Initially, the Regional Coordinator (RC) visited each country in the region with a questionnaire and compiled the major constraints to sorghum and millet production that have regional significance. This was done under each discipline with the help of national program scientists. During the 5th regional workshop in 1986, the workshop participants identified the common priority problems. As a follow up, the Steering Committee (SC) members met in Ethiopia in 1986 to discuss and find solutions to these problems. For each research problem, the following points were discussed and reported: Definition, description, current status, future research approach to tackle the problem, and finally, the identification of "Lead Research Centers".

The RC developed the collaborative research projects with the identified Lead Research Centers in NARS. After approval of the projects, the RC made available some inputs for the proper execution of each project. Each year the RC met with the SC to review and monitor the progress and achievements for each project.

List of collaborative projects with NARS and Lead Centers

Project	Lead Centers
Striga	Ethiopia
Ergot	Ethiopia and Rwanda
Crop improvement	Ethiopia and Kenya
Stem borer	Kenya (ICRISAT) and Uganda
Long smut	Kenya
Agro-ecological zone classification	ICRISAT Center

COLLABORATIVE RESEARCH RESULTS IN PHASE II

Striga (Reported by IAR/Ethiopia)

1. Sorghum variety screening against Striga

The varieties or lines of sorghum included in this experiment are mostly obtained from SAFGRAD/ICRISAT and some locally developed (ESIP) materials. In 1987, 30 varieties were sown at Lower Birr and Beles State Farms, Shewa Robi and Gumaide. In the Gumaide site, 11 local varieties (land races) were included and the screening was against S. asiatica, unlike the other three sites

which are for S. hermonthica. The trial at Shewa Robi failed because of drought and the result at Lower Birr was unsatisfactory because of a similar reason at the beginning. Varieties found to be promising (i.e. having <25% of adjacent control) at Lower Birr, Beles and Gumaide were the following:

Beles	Lower Birr	Gumaide
SAR-24	ICSV-1006	Framida
Tetron	ICSV-1007	ISCV 1007
ICSV-1006		N-13
SR-5 N-19892	SR-9 (148)	ISCV 1005
UCHV	SR-5 NJ 19892	76 Ti 23
	Dobbs	Seredo
	Seredo	Dinkmash-86
		Short Kulisha (local)
		Serere Comp 2 (millet)

After consultations with the sorghum breeders in the IAR, some modifications were made for the 1988 trial and they are in the field at present. With the ample rains this year, it is expected that better results will be obtained than the previous year from all the research sites.

2. Striga herbicide trial

Eventhough this trial was undertaken at Lower Birr, Beles and Shewa Robi, it was only the Beles one which gave some result. Five herbicides were sprayed at different growth stages of sorghum and/or Striga. The result was as follows:

Herbicide	Time of application		Striga control
	Sorghum	Striga	
Chlorsulphuron	pre-em	pre-em	No
2, 4-D	6 wks. a.em	emergence	killed emerged striga
"	8 1/2 "	15 cm	killed emerged striga
"	6&8 1/2 "		killed emerged striga
"	10 1/2 "	flowering	prevented flowering
"	14 1/2 "	seed set-ting	did not prevent seeding
Dicamba			
Dicamba	6	"	No
Gluforimate	14 1/2	"	No
Oxyflurfen	8 1/2	"	prevented flowering

This trial is repeated this year and more attention is being given to 2,4-D because it has performed well. It is cheap and available locally.

3. *Striga*/sorghum variety/nitrogen trial

Four varieties of sorghum, viz IS 9302, IS 8686, N-13 and Athuraifere were used. DAP at 100 kg/ha at planting and urea at 0,75 and 150 kg/ha applied at the time of thinning were also compared. The result is summarized below:

Treatments	<i>Striga</i> counts	Yield of sorghum
IS 9302 (control)	15 shoots/m ²	10.4 q/ha
Framida	< 20% of control	33.3 "
N-13	< 50% of control	11.4 "
Athuraifere	highest at the end	1.3 "

At Beles, where the trial was conducted, the soil is so fertile that the response of the sorghum to the additional nitrogen was not pronounced. In variety Framida, the double dose had negative effect on the yield. This trial is also repeated this season in order to obtain conclusion results.

4. *Striga*/time of planting/catch cropping trial

Five varieties of sorghum were sown to find out the appropriate time of planting that suppresses *Striga* infestation and sudan grass was used as a preceding crop to the most susceptible variety and harvested before sowing that variety. Two dates of planting, May and July were selected based on the onset of the small rains and the rainy season; maturity periods of the variety.

Due to shortage of rain in June 1987, it is assumed that the intensity of *Striga* was very low in general. However, at Harbu research site, catch-cropping showed some benefit and late planting of Gambella 1107 was found to be advantageous. The summary of the results was as follows:

Variety	Sowing date	Striga/plot	Yield (q/ha)
Jiru	10 May	7.0	10.2
Atkuraifere	10 May	3.3	22.2
S. grass, IS9302	10 May, 28 May	2.5	12.3
IS9302	28 July	10.0	15.2
Gambella 1107	28 July	1.0	24.7
N-13	28 July	0.3	17.3

5. Striga hand-pulling trial

This is a long-term trial, the effect of which cannot be seen within a year.

6. Integrated pot experiments on striga are being conducted by IAR scientists and results are underway.

2. Ergot (Reported by IAR/Ethiopia and ISAR/Rwanda)

ICRISAT pathologists and the regional coordinator transferred the screening technique for inoculation for ergot to Ethiopian and Rwandese scientists in their own country to identify ergot resistant sorghum genotypes.

In Ethiopia, over 300 entries were inoculated in 1987 and only 48 entries had good levels of resistance showing less than 10% ergot infected florets. The 48 entries were replanted at Arsi Negele in 1988 and inoculated to reconfirm their resistance, and 11 entries had the required level of resistance.

In Rwanda, inoculation was made on 65 local varieties at Rubona and Karama stations. IS 25535, IS 25549, IS 25550, IS 25553, IS 25559, IS 25569 and Ikinyaruka were identified as probably resistant genotypes. These genotypes are now planted in Rubona to reconfirm their resistances.

3. Crop improvement

Ethiopia and Kenya have contributed advanced breeding sorghum lines and were dispatched to other countries in the region by the RC in 1987 in the form of Regional Observation Nurseries, consisting of 160 elite entries which were increased by IAR/Ethiopia for evaluation in the lowland and highland areas of Eastern Africa. In addition, 60 segregating sorghum lines from Ethiopia (Annex V) and 24 varieties and hybrids from ICRISAT were included in the observation nurseries.

4. Stem borer (Reported by ICIPE/Kenya)

One hundred thirty four sorghum varieties from eastern Africa countries were given to ICIPE in 1986 by the RC to screen them for resistance under artificial infestation with stem borer *Chilo partellus* at ICIPE's Mbita point field station in Kenya.

The following entries showed good level of resistance as compared to the susceptible check. 8352/KAJ/NO., 506, 511, 653, Cross 60:6, ICSV 83570, 83369 and 83620.

Uganda received from the regional coordinator the ICIPE resistant entries and ICRISAT resistant entries for evaluation in hot spot at Serere. No results have been received. The Steering Committee felt that the responsibility for stem borer research be transferred from Uganda at this stage.

5. Long smut (Reported by KARI/Kenya)

Surveys for sorghum long smut caused by *Tolyposporium ehrenbergii* were made in four districts of eastern provinces of Kenya in 1987 and 1988. Long smut was found in Meru and Embu. The disease incidence in the farmers' fields varied from 3.7% in Meru to 3.3% in Embu. At Marimanti experiment station the disease incidence varied from 28.6% in the most susceptible genotypes to 0% in the most resistant variety IS 8595 (local). A comparison of sporidia and chlamydospores as source of inoculum showed that sporidia was more efficient in causing infection. Sorghum plants inoculated with sporidia just before the heads emerge from boot was found to be the most effective method. No infection occurred on plants inoculated when heads had fully emerged. Out of several lines screened at Marimanti under natural condition, 18 genotypes were found to be resistant to long smut. These 18 genotypes were further screened in 1987 in the glasshouse at Muguga. ICSV 212 and QL3 showed good level of resistance.

However, in 1988, a local variety IS 8595 was found to be resistant in field and glasshouse conditions. Seeds are available from Muguga on request. The project will continue to identify more genotypes with high level resistance. A joint manuscript with NARS is written and is under preparation for submission for publication.

6. Agro-ecological zone grouping

Agro-climatic data was collected from each country in eastern Africa by the regional coordinator and was supplied to Dr. Virmani, in charge of agro-climatology department at ICRISAT Center, for analysis. Initial grouping and characterization of different sets of environments in eastern Africa was presented during the Somalia workshop. Additional and more recent data on agroclimatic features will be collected in order to produce more realistic classification of the different sets of environments. In the near future, results from regional advanced field trials for different ecological zones, coupled with agroclimatic data, should allow a better interpretation of the data.

Follow-up of the collaborative projects by the RC:

- 1) Dissemination of the resistant genotypes through uniform yield trials in hot spots by NARS in the region.
- 2) Transfer of relevant technology from local lead centers to recipient countries through regional short course and regional workshops.

B. Germplasm movement and evaluation

Germplasm movement in the region from NARS to NARS and ICRISAT to NARS is extremely important for the sorghum and millet improvement program. A vast number of introductions were made by the RC to different National programs with respect to the collaborative research (see appendix II). In addition, the RC, in 1987, organized a Regional Observation Nurseries to all cooperators for the lowland and intermediate/highland areas for eastern Africa countries. The entries included in these nurseries came from NARS and ICRISAT (see table 1 and 2).

The schematic diagram followed by EARSAM for the regional germplasm movement and evaluation is shown on page 13.

Table 1

EARSAM ELITE SORGHUM YIELD TRIAL - 89 (EESYT-89).
LOWLAND LEVEL

Entry No.	Variety	Source	Pedigree
1	5DX 160	Burundi	
2	Dinkmash	Ethiopia	
3	IS 2284	Ethiopia	
4	BTX 629	Ethiopia	
5	M 36121	Ethiopia	
6	KAT/83487	Kenya	
7	KAT/83369	Kenya	
8	Kigufi	Rwanda	
9	1804	Rwanda	
10	PP-290	Somalia	
11	M 90411	Somalia	
12	ICSV 335	ICRISAT	
13	Gudam Hamam	Sudan	
14	CR:35:5	Sudan	
15	ICSV 401	ICRISAT	
16	RSAVT-Ent 6	Tanzania	
17	RSAVT-Ent 8	Tanzania	
18	RSAVT-Ent 13	Tanzania	
19	3KX 76/7	Uganda	
20	ICSV 219	ICRISAT	
21	76 T ₁ #23 (IS76)	Ethiopia	
22	Framida	Ethiopia	
23	ICSV 112	ICRISAT	
24	Seredo	Control	
25	Hageen Durra 1	Control	

Table 2

EARSAM ELITE SORGHUM YIELD TRIAL - 89 (EESYT-89)
INTERMEDIATE LEVEL

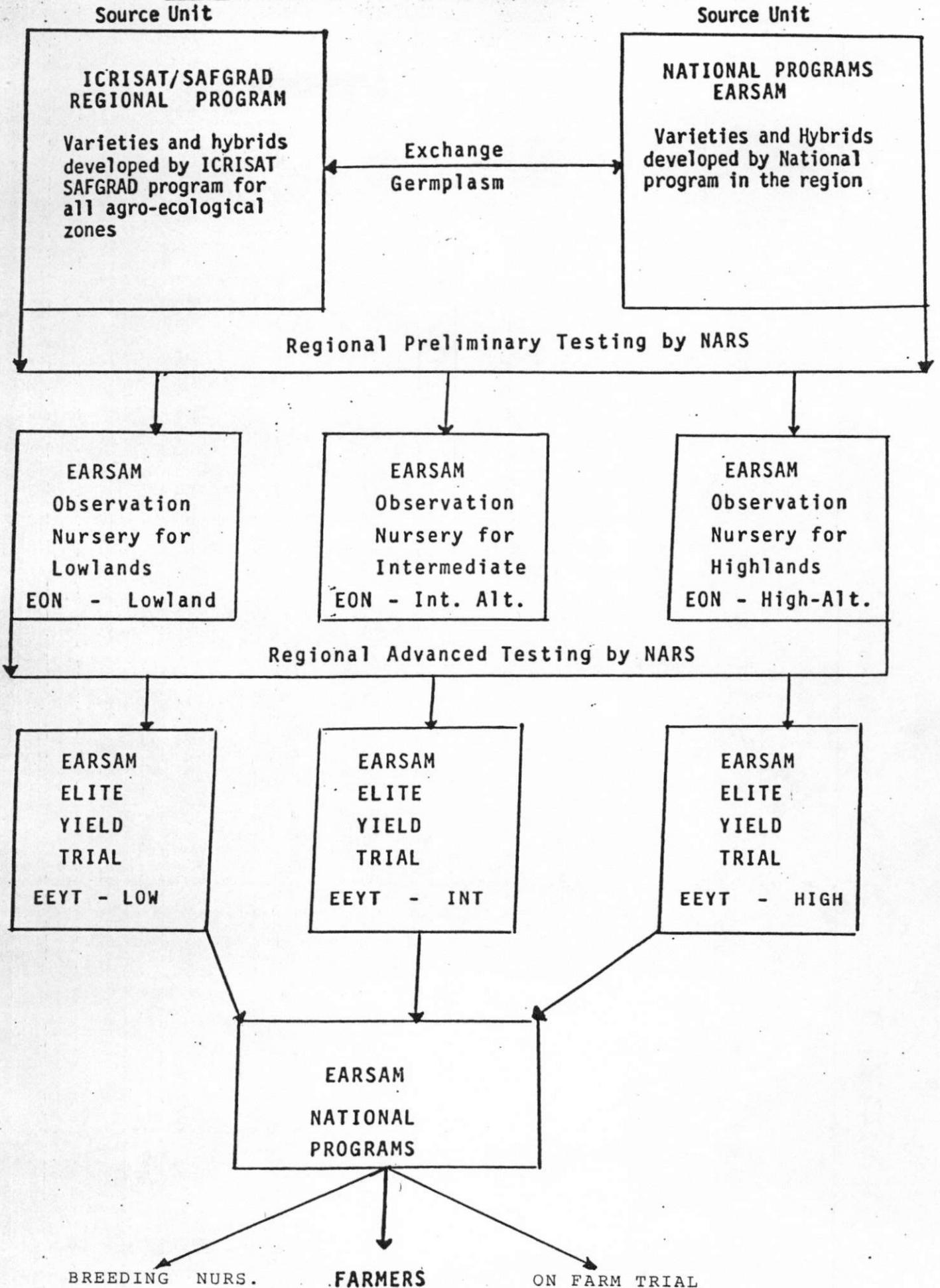
Entry No.	Variety	Source	Pedigree
1	82 HPYT-1 # 6	Ethiopia	
2	85 MW 5340	Ethiopia	
3	85 BK 6136	Ethiopia	
4	84 MK/4/38	Ethiopia	
5	IS 8193	Kenya	
6	Amasugi	Rwanda	
7	Nyirakabuye	Rwanda	
8	TSX 183/2/2/1/1	Tanzania	
9	TSX 142/6/2/1/3	Tanzania	
10	4MX 37/101	Uganda	
11	4MX 11/9/2	Uganda	
12	IS 9302	Ethiopia	
13	3ZX 379/2	Uganda	
14	Seredo	Control	
15	Serena	Control	
16	ICSH 153 (CSH 11)	Control	

Varieties and hybrids developed by ICRISAT/SAFGRAD and national programs will be included in EARSAM observation nurseries for different agro-ecological zones and promising materials identified by NARS will be included in EARSAM elite yields trials for different agro-ecological zones in the region. The national programs will then evaluate these trials and will identify materials to be tested on farmer's field or include in their breeding program.

The germplasm movement and evaluation in the region has helped the National programs in releasing or proposing for release some sorghum (page 14) and millet (page 15) varieties to farmers. These products of research are extremely important to the farmers in the region and the flow of germplasm movement and evaluation will be a continuous process to further improve the agronomic problems and stability of yield for the farmers.

Not all priority problems identified by the SC are addressed at this stage because of funding limitations, lack of expertise and facilities. Moreover, these same problems have limited the participation of some national programs in the region in collaboration projects.

EARSAM REGIONAL GERmplasm MOVEMENT AND EVALUATION



SORGHUM VARIETIES RELEASED AND PROPOSED FOR RELEASE BY NARS IN EASTERN AFRICA (1986-1988)

Country	Highland	Intermediate	Lowland
Ethiopia	1) 82 HPYT-#21 (PR) (IS 158 x (ET3235)BC4)	1) 85 MW 5340 (PR) (RS/R-20-8614-2xIS9379) 2) 85 BK 6136 (PR) (RS/R-20-8614-2xIS 9293)	1) Dinkimash 86 (R) (CS-108-3xCS 3541)-19-1 2) IS 2284 (PR) 3) Seredo (R)
Uganda	-	1) ET 525 HT (PR) 2) 2KX 17/B/1 (Tegemeo) (PR)	1) E 525 HT (PR) 2) 3 KX 73/1 (PR)
Rwanda	-	1) WS 1297 (R) Amasugi (PR)	1) 5D x 160 (R)
Burundi	-	1) SVR-8 (R)	1) Tegemeo (PR) 2) Gambella (PR)
Tanzania	-	-	1) Tegemeo (R)
Somalia	-	-	1) PP 290 (PR) 2) LV 175 (PR)
Kenya	-	1) 2 Kx27 (R) 4) IS 8527 (PR) 2) Serena (R) 5) IS 8293 (PR) 3) Seredo (R) 6) IS 76 (PR) (76 T1#23)	1) KAJ 369 (PR) (Eastern)
Sudan			1) Cross 35-5 (PR)

Note : (R) = Released, (PR) = Proposed for release

MILLET VARIETIES RELEASED AND PROPOSED FOR RELEASE BY
NARS IN EASTERN AFRICA (1986-1988)

Country	Pearl Millet	Finger Millet
Sudan	Bristled Pop. (PR) Kordofani (PR) Faki Mustaki (PR)	-
Kenya	KAT PM 1 (PR) KAT PM 2 (PR)	KAT FM1 (PR)
Tanzania	SADCC/TARO Composite (PR)	-
Ethiopia	-	3 (PR)
Uganda		P 224 (R) Serere P 277 (PR) 4-10 (PR)

Note: (R) = Released, (PR) = Proposed for release

C. Involvement of universities and private agencies in research

The EARSAM network, in addition to NARS, has initiated collaborations with universities and private agencies and institutes in research directly or indirectly. The objectives of promoting research collaboration among these regional programs would be to avoid overloading NARS with different activities and also by avoiding unnecessary duplication of activities with national programs in order to stabilize and enhance the efficiency and effectiveness of the respective networks with common interests.

Possibilities for research collaborations have been discussed at this stage with the following institutes:

- Nairobi University, Makerere University, Alemaya University, Kenya Seed Company, SADCC, ICRISAT center, IDRC, USAID REDSO, INTSORMIL and Global 2000. Scientists from these institutions participated in EARSAM regional workshops.

D. Research support to NARS

a) Consultancy and technical support:

The RC visited each country in the region where different collaborative research are underway and assisted NARS as the need arose for a specific transfer of technology, advise and germplasm movement from ICRISAT and NARS. Experts from ICRISAT in different disciplines visited NARS with the RC to transfer research techniques and information.

b) Financial - equipment and research supply support

Kenya and Rwanda have received modest financial support for the long smut and Ergot collaborative projects. In the future, more financial support will be needed (Annex VI) and this depends on the availability of funds for research support.

In case of Ethiopia and Kenya, small equipments have been provided for the initiation of the striga and long smut collaborative projects respectively. Other countries such as Kenya, Rwanda, Ethiopia and Somalia received research supplies as the need arose for the proper execution of the collaborative projects. More support of this kind will be needed in the future. Storage of funds have limited the number of identified problems to develop collaborative projects with few countries in the region.

OTHER NETWORK ACTIVITIES

A. Regional Workshops

The RC successfully organized the following regional workshops for EARSAM:

- a) The fifth EARSAM regional workshop was held in Burundi, Bujumbura, July 5-11, 1986.
- b) Sorghum and millet seed production regional short course workshop for Eastern and Southern Africa, was held in Kenya, Nairobi, Sept. 13 to 19, 1987.
- c) The sixth EARSAM regional workshop was held in Somalia, Mogadishu, July 20 to 27, 1988.

The proceedings of the three regional workshops have been edited and printed and distributed to all the cooperators in the region. All the resolutions and recommendations of each workshop have been successfully executed by the RC, except the ones that require additional funds and expertise, eg. degree training and drought research.

B. EARSAM Steering Committee meetings

Because of the existence of too many different networks in the region and limited funds, the RC tried to combine the SC meetings with the regional workshops wherever possible for the following reasons:

- a) To save money and use the savings to support the collaborative research projects.
- b) Not to overburden the national program scientists who are on the SC with too many frequent trips outside their country so that they concentrate on their research activities.

The following SC meetings have been held in the region:

1. The first SC meeting was held in Ethiopia, Oct 20-25, 1986.
2. The second SC meeting was held in Kenya, Sept 20 to 27, 1987.
3. The third SC meeting was held in Somalia, July 20 to 27, 1988.
4. The fourth SC meeting was held in Kenya, Nov. 2 to 5, 1988.

The minutes of all the SC meetings were written and distributed.

C. Conference, field day and monitoring tours

1. The SC members together with the RC visited the Ethiopian sorghum and millet improvement program in Oct. 23 to 24, 1986 and selections were made by the SC and seeds were dispatched to Kenya, Sudan and Uganda.
2. Scientists from Kenya and Burundi together with the RC participated in the ICRISAT field day in September, 1986. As a result, selections were made in sorghum and millet and collaborative projects were developed.

3. The EARSAM pathologists and breeders from Ethiopia, Kenya, Rwanda, Somalia and Uganda, together with the RC attended the sorghum and millet Global pathology workshops organized by SADCC in Harare, Feb. 6 to 12, 1988. After the workshop, a monitoring tour was organized to visit the research plots at Matopos and sorghum breeding materials were selected and dispatched.
4. Scientists from Ethiopia, Kenya, Rwanda and Burundi together with the RC participated in the ICRISAT field day in Sept. 20 to 23, 1988.

In most cases, invitations were sent to all countries in the region.

D. Training

Three different kinds of training are being offered to EARSAM national program scientists.

a) In-service training at ICRISAT Center

The number of scientists from EARSAM trained in different disciplines at ICRISAT center supported by different sponsors (1986-1988) (Refer Annex III).

b) In-country training

The following countries received in-country training in different disciplines:

Kenya : Long smut short course training for Mr. J. Songa at Muguga, KARI.

Sorghum improvement 8-month training for Mr. D. Alembi by the RC. Also worked very closely with Mr. B. Kenyenji in sorghum improvement in 4 different stations.

Rwanda : Consultancy offered by ICRISAT pathologist, Dr. R. Bandyopadhyay to Mr. Thaddee M. and C. Sehene on ergot and downy mildew diseases of sorghum.

Ethiopia: Consultancy offered by ICRISAT pathologist, Dr. R. Bandyopadhyay to Mr. Girma Tegne and Mohamed Yesuf on ergot disease of sorghum.

Somalia : Consultancy offered by the RC to the Somali sorghum breeders on improvement and suggested strategies for sorghum breeding.

c) In-region training

In EARSAM network, every other year a regional short course is being offered to EARSAM scientists. In 1987, a regional short course on seed production was offered to production scientists and breeders in Nairobi which arose from a request made by the national program scientists during the 5th regional workshop in 1986. In 1989 a regional short course will be organized on crop protection for EARSAM scientists. As a result of such regional short courses, a teaching manual will be produced for national program scientists by the RC.

E. Scientific information

The RC has distributed to some EARSAM scientists the following scientific documents:

- Proceedings, teaching aids, literature, slides and ICRISAT publications books on sorghum and millet.

F. ICRISAT's contributions to EARSAM network

The EARSAM steering committee members appreciate ICRISAT's involvement and contributions to the national programs in eastern Africa. EARSAM receives the following support from the ICRISAT center:

- a) Technologies and improved sorghum and millet breeding material developed by ICRISAT scientists to NARS in the region (Annex III)
- b) Strengthen research capabilities of NARS by providing in-service training as well as facilities for degree training Somalia and Kenya) (Annex II).
- c) Qualified ICRISAT scientists to assist NARS in conducting research aimed at developing simple and relevant technologies for the region.

- d) Make available equipment or materials not available in the region (Annex VI).
- e) Basic research that is still outside the competence of NARS that will contribute to the objective of the EARSAM network.
- f) Scientific information for national program.

G. NARS contribution to EARSAM Network

Research lead centers have been identified by the SC members to undertake collaborative research projects on the basis of the existing strengths within NARS as far as research facilities and scientific personnel are concerned. As mentioned in earlier pages the large amount of improved germplasm for various uses has been contributed by national programs for use in the region. There has been positive involvement of the NARS and their willingness to contribute their research facilities and equipment and scientific personnel to undertake the collaborative research projects which will eventually benefit their own country and the region should contribute significantly to the regional effort.

H. SAFGRAD's contribution to EARSAM network

SAFGRAD has a new focus on networking and developing leadership within NARS. An Oversight Committee for all of SAFGRAD's networks has been selected to fulfil the following functions:

- a) Provides guidance in management and policy issues of SAFGRAD.
- b) Provides an OAU umbrella with diplomatic immunity.
- c) Reviews work plans and provide guidance on how SAFGRAD can give effective services to national programs of OAU/SAFGRAD member countries.
- d) Reviews annual technical progress of network activities.
- e) Provides funds through USAID for implementation of network activities.

I. Proposals and publications

Proposals

- a) A project proposal for a regional sorghum and millet research and training program for the CDA countries of eastern Africa. (Feb 15, 1986). V. Guiragossian and B. Gebrekidan.

- b) Integrated collaborative research proposal among Katumani/Kiboko/ICRISAT for grain and fodder. V. Guiragossian
- c) Sorghum/millet processing and utilization collaboration proposal among KARI/KIRDI/EARSAM. V. Guiragossian
- d) Proposal for supplemental funding to national research programs for sorghum and millet improvement. V. Guiragossian

Annual reports

- a) Annual progress report for EARSAM - 1986
- b) Annual progress report for EARSAM - 1987
- c) Annual progress report for EARSAM - 1988

Proceedings

- a) Proceeding of the 5th EARSAM Regional Workshop - July 5 to 11, 1986. Bujumbura, Burundi.
- b) Proceedings of sorghum and millet seed production regional short course of eastern and southern Africa countries.
- c) Proceedings of the 6th EARSAM Regional Workshop - July 20 to 27, 1988, Mogadishu, Somalia.

Papers presented

- a) Sorghum production constraints and research needs in Eastern Africa. V. Guiragossian - 5th regional workshop.
- b) Breeding for environmental stresses: Drought and cold tolerance. V. Guiragossian - 5th regional workshop.
- c) The use of grain sorghum for beverages in Rwanda. C. Sehene and V. Guiragossian - 5th regional workshop.
- d) Sorghum varietal description release cultivars, naming and registration. V. Guiragossian - Seed production workshop.
- e) System of production of breeders and basic seed in sorghum. V. Guiragossian - Seed production workshop.

- f) Sorghum seed quality guidelines for the small farmers. V. Guiragossian - Seed production workshop.
- g) A regional network to improve sorghum and millets in Eastern Africa. V. Guiragossian - 6th regional workshop.
- h) Sorghum long smut in Kenya. J. Njuguna, V. Guiragossian et. al. (6th regional workshop).

EARSAM BUDGET REQUIREMENTS

In order to further strengthen the network activities, the network will need additional funds to meet the following requirements:

- a) EARSAM's sorghum and millet training needs (ANNEX VI).
- b) Station development in NARS
- c) Research equipment and supplies (ANNEX VII)
- d) Transport facilities

A proposal has been developed by the RC and sent to SAFGRAD headquarters for submission for possible funding.

FUTURE WORK PLAN

EARSAM network will in the future concentrate on the following:

- a) Develop and implement new collaborative research projects of high priority on sorghum and millets with NARS.
- b) Transfer of collaborative research technology and germplasm generated by NARS to NARS and by ICRISAT to NARS.
- c) Provide more financial support to national programs for research equipments and supply.
- d) Encourage the involvement of private, public and international institutions in the region .
- e) Conduct more regional training courses in specialized disciplined short course for scientists and technicians.

ANNEX I. Acreage and production statistics for sorghum, millet and maize in the region.

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Items	Burundi	Ethiopia	Kenya	Rwanda	Tanzania	Somalia	Sudan	Uganda
1. Population (millions, 1985)	4.5	40.9	18.9	5.7	19.0	5.1	20.8	13.9
2. Major cereal crops in production order	SMRW	TBSMW	MSWR	SMRW	MSR	SMR	SFMW	SMRW
3. Sorghum area (ha)	180,000	910,000	160,000	145,000	800,000	500,000	4,896,000	200,000
4. Sorghum production (tons)	220,000	1,100,000	130,000	184,000	670,000	251,000	3,605,000	300,000
5. Millet area (ha)	50,000	230,500	60,000	3,000	322,000	Nil	1,485,000	350,000
6. Millet production (tons)	50,000	200,000	65,000	2,000	273,000	Nil	544,000	350,000
7. Maize area (ha)	135,000	810,000	1,398,000	87,000	1,905,000	350,000	70,000	280,000
8. Maize production (ha)	160,000	1,500,000	2,650,000	121,000	2,210,000	382,000	30,000	400,000

Source: 1. Designated by the Consultative Group on Food Production and Investment

2. Designated by the Ministry of Agriculture of each country

3, 4, 5, 6, 7 & 8: Designated by FAO Production Year Book, 1986.

Note: Maize = M, Sorghum and Millet = S, Rice = R, Wheat = W, Barley = B, Teff = T

ANNEX II. Germplasm movement and evaluation

1. Seed introduction in Kenya for EARSAM in 1986

A vast number of introductions were made by the RC to Kenya in 1986. The RC worked closely with KARI scientists in Kenya at Katumani, Kiboko, Marimanti, Kampi ya Mawe, and Muguga research station and provided financial support for the evaluation of the following breeding materials.

1. About 500 F₂ individual sorghum plant selections from the Mexican highland ICRISAT/CIMMYT program.
2. About 300 advanced sorghum lines from the Mexican lowland ICRISAT/CIMMYT program.
3. About 700 F₂ individual sorghum plant selections from the Mexican lowland/intermediate ICRISAT/CIMMYT program.
4. Genetic male sterile sorghum population for highland areas from the ICRISAT/CIMMYT program.
5. Genetic male sterile sorghum population for the lowland/intermediate areas for the ICRISAT/CIMMYT program.
6. Pearl millet synthetic variety for highland dry areas.
7. Proso and foxtail millet collection.
8. 250 pairs of A and B lines and about 100 R lines for hybrid development.

II. Seed distribution to EARSAM cooperators in 1987

During 1987, SAFGRAD/ICRISAT coordinator distributed the following experiments on sorghum:

1. Sorghum observation nursery:
 - a) For lowland to all EARSAM cooperators and Mexico/CIMMYT
 - b) For highland to Burundi, Rwanda, Uganda, Kenya and Mexico/CIMMYT.

2. Striga resistant varieties to Ethiopia for striga collaborative project.
3. Stalk borer and shootfly experiment - to Kenya, Somalia, Sudan, Uganda, Ethiopia, Burundi and ICIPE.
4. Special requests from Zimbabwe (Bulawayo) and Somalia for sorghum drought tolerant selections from Kiboko research station.
5. Experimental and elite sorghum hybrids for Kenya and Somalia.

III. Genetic material supplied to EARSAM in 1988

During 1988, SAFGRAD/ICRISAT coordinator distributed the following genetic materials:

1. Kenya:
 - a) Elite pearl millet varieties were introduced from SADCC program to Katumani research station.
 - b) Finger millet collection was introduced from SADCC program to Katumani research station.
 - c) Elite sorghum varieties, A and B and R lines and hybrids were introduced from ICRISAT sorghum program to Katumani research station.
 - d) Two sets of striga resistant varieties were introduced from West Africa to Alupe and Katumani research stations.
 - e) Three genetic male sterile populations were introduced from ICRISAT center to Katumani research station.
 - f) Two sets of International Sorghum Trials (ISTN) were introduced from ICRISAT center to Alupe and Kiboko research stations in Kenya.
 - g) Twenty six elite varieties were introduced from the Ethiopian sorghum improvement program to Kiboko research station.
 - h) Eight hundred thirty eight converted sorghum lines were introduced from ICRISAT GRU unit to Katumani research station.

2. Somalia:

- a) Five elite synthetic varieties of pearl millet were introduced from Katumani research station (Kenya) to Bonka research station in Somalia.
- b) Thirty drought tolerant sorghum lines were introduced from Kiboko research station (Kenya) to Bonka research station in Somalia.
- c) Three genetic male sterile populations were introduced from ICRISAT center to Bonka research station in Somalia.
- d) One set of International sorghum trial (ISTN) was introduced from ICRISAT center to Bonka research station in Somalia.
- e) One set of International sorghum variety and hybrid observation trial (ISVAT 87) was introduced from ICRISAT center to Bonka research station in Somalia.

3. Sudan

- a) Elite pearl millet varieties were introduced from SADCC program to Sudan for the Global 2000 program.
- b) One set of International sorghum trial (ISTN) was introduced from ICRISAT center to Wad Medani in Sudan.

Ethiopia:

- a) One set of striga resistant varieties were introduced from ICRISAT West Africa to Ethiopian sorghum program for the striga collaborative project.
- b) Varieties were selected by the Ethiopian breeder and RC from SADCC nurseries and were sent to Ethiopia.
- c) Genetic male sterile sorghum population for highland areas.

Rwanda

- a) 250 sorghum collection from ICRISAT center were introduced to Rubona station in Rwanda
- b) Nine genotypes for striga resistance were sent to Rubona station in Rwanda.

ANNEX III. Training (1986-1988)

1. Country	In-service
-----	-----
Burundi	3
Ethiopia	5
Kenya	6
Rwanda	2
Somalia	9
Sudan	7
Tanzania	4
Uganda	2
-----	-----
Total	38
-----	-----

MSc. using ICRISAT facilities Total (8)

2. ICRISAT's Staff Involvementa) At regional workshops

- i) During the 5th regional workshop held in Bujumbura in 1986, five ICRISAT staff from different disciplines attended and presented scientific papers.
- ii) During the regional seed production short course held in Nairobi in 1987, four ICRISAT staff attended and presented scientific papers.
- iii) During the 6th regional workshop held in Mogadish in 1988, eight ICRISAT staff attended and presented scientific papers.

b) Consultancy to NARS in the region

- i) Consultancy offered by ICRISAT pathologist and RC to KARI/Muguga in Kenya on long smut disease of sorghum.
- ii) Consultancy offered by ICRISAT pathologist and RC in Rwanda and Ethiopia on ergot disease of sorghum.
- iii) Consultancy offered by the RC in Somalia, Burundi, Rwanda, and Kenya on sorghum improvement.

C. Other assistance to NARS

- i) Chemical analyses carried out by ICRISAT for MUSALAC food product in Burundi.
- ii) Chemical analyses carried out by ICRISAT/CIMMYT program for local beverages in Rwanda.
- iii) Chemical analyses carried out by ICRISAT/CIMMYT program for different sorghum seeded types for injera making in Ethiopia.

ANNEX IVDirect funds, equipment and field supplies provided to NARS

Country	Amount in US\$	Purpose
Ethiopia	4,000	For ergot and striga collaborative research project
Kenya	15,000	For crop improvement and long smut collaborative research projects
Rwanda	5,500	For Ergot and downy mildew collaborative research project.
Note: ICIPE	20,000	For stem borer collaborative research project.

ANNEX V - Germplasm contribution to EARSAM from IAR/Ethiopia

1. Sorghum selections made by the SC in 1986 were dispatched by IAR/Ethiopia to RC
2. One hundred sixty improved and local varieties were increased by IAR/Ethiopia and were included in the regional observation nursery.
3. Three highland cold tolerant varieties were sent by IAR/Ethiopia to the RC.
4. Thirty six improved sorghum varieties were sent by IAR/Ethiopia to the RC
5. Two hundred seventy six F₂ selections were sent to the RC by IAR/Ethiopia.

ANNEX VI. Current level of research manpower in EARSAM countries.

Countries	Ph.D.	M.Sc.	B.Sc.	Technicians
Burundi	0	0	0	5
Ethiopia	1 (B)	1 (A) 2 (P)	2 (B) 1 (A) 1 (E) 1 (U)	10
Kenya	0	1 (B) 1 (A)	1 (MB) 2 (B) 1 (A)	5
Rwanda	0	1 (P)	1 (B)	3
Somalia	0	3 (B) 2 (A) 1 (F)	1 (FS) 1 (S) 1 (A)	1 (E)* 1 (P)* 5
Sudan	2 (P) 1 (E) 1 (A) 3 (SB)	1 (EC) 3 (U) 1 (P) 1 (MB)	0	9
Tanzania	1 (A) 1 (P)	1 (B)	1 (B) 1 (E) 1 (P)	
Uganda		1 (A) 2 (B)	1P* 1 (E) 1 (E)	4

Note: (B) = Breeder (E) = Entomologist
 (A) = Agronomist (P) = Pathologist
 (U) = Utilization (FS) = Farming System
 (S) = Soils (EC) = Economics
 (SB) = Sorghum Breeder
 (MB) = Millet Breeder
 * = Advance degree training

Table 1. EARSAM's Sorghum Training Requirements - 1989 to 1998.

Year	<u>BURUNDI</u>				<u>ETHIOPIA</u>				<u>KENYA</u>			
	<u>Level of training</u>				<u>level of training</u>				<u>Level of training</u>			
	<u>Scientists</u>				<u>Scientists</u>				<u>Scientists</u>			
	Ph.D.	M.Sc.	B.Sc.	Techn.	Ph.D.	M.Sc.	B.Sc.	Techn.	Ph.D.	M.Sc.	B.Sc.	Techn.
1989-90	0	0	1	1	2	4	2	2	2	2	7	8
1991-92	0	1	1	1	2	0	2	4	1	3	2	5
1993-94	0	1	1	1	0	1	2	4	1	4	3	3
1995-96	1	1	1	1	1	0	2	2	0	1	3	2
1997-98	1	1	1	1	0	0	1	4	1	2	2	3
Total	2	4	5	5	5	5	9	16	5	12	17	21
	<u>TANZANIA*</u>				<u>UGANDA</u>				<u>RWANDA</u>			
1989-90	1	3	2	6	1	2	4	8	0	0	2	2
1991-92	0	2	4	4	1	1	2	2	1	2	2	2
1993-94	1	2	2	2	1	1	2	5	0	1	0	4
1995-96	2	1	4	1	1	2	2	5	1	0	0	0
1997-98	1	1	2	1	1	2	2	5	1	0	0	0
Total	5	9	14	14	5	8	12	25	3	3	4	8
	<u>SOMALIA</u>				<u>SUDAN</u>							
1989-90	1	1	2	4	0	1	0	2				
1991-92	2	1	2	4	0	1	0	2				
1993-94	1	1	2	4	0	1	0	2				
1995-96	2	2	2	4	1	0	0	2				
1997-98	2	2	2	4	2	0	0	1				
Total	8	7	10	20	3	3	0	9				

PROBLEM ORIENTED SPECIAL TRAINING OF SCIENTISTS (1989-1998).

Activities	Burundi	Ethiopia	Kenya	Rwanda	Somalia	Sudan	Tanzania	Uganda
✓ 1. Drought	2	5	2	2	5	3	6	6
✓ 2. Striga	1	4	4	3	2	3	4	6
✓ 3. Plant protection	2	6	4	3	3	2	4	8
4. Station management	2	4	3	2	4	1	4	4
5. On-job-training	3	4	10	2	8	1	15	12
✓ 6. Processing and utilization	2	2	4	3	2	3	3	3
7. Farming systems	2	2	2	2	2	1	3	2
8. Crop improvement	4	3	2	4	2	3	2	3

EARSAM's Millet Training Requirements - 1989-1998.

Year	ETHIOPIA				KENYA				UGANDA				SUDAN			
	<u>Level of training Scientists</u>				<u>Level of training Scientists</u>				<u>Level of training Scientists</u>				<u>Level of training Scientists</u>			
	Ph.D	M.Sc	B.Sc	Tech	Ph.D	M.Sc	B.Sc	Tech.	Ph.D	M.Sc.	B.Sc.	Tech	Ph.D	M.Sc.	B.Sc.	Tech.
1989-90	0	1	1	2	1	1	3	4	1	2	4	6	0	1	0	1
1991-92	0	0	0	0	0	2	2	5	1	0	2	2	0	0	0	1
1993-94	1	0	1	2	1	2	3	4	1	1	1	2	0	0	0	1
1995-96	1	1	0	0	0	2	0	4	1	1	1	5	1	0	0	0
1997-98	0	0	1	2	0	2	2	0	1	2	2	5	0	0	0	1
Total	1	2	3	6	2	9	10	17	5	6	10	20	1	1	0	4

EARSAM's Sorghum Training Requirements (summary table).

Year	Level of Training			
	Ph.D	M.Sc.	B.Sc.	Technicians
1989-90	7	13	20	33
1991-92	7	11	15	24
1993-94	4	12	12	25
1995-96	9	7	14	17
1997-98	9	8	10	16
Total	36	51	71	115

EARSAM's Millet Training Requirements (summary table).

	Level of Training			
	Ph.D	M.Sc.	B.Sc.	Technicians
1989-90	2	5	8	13
1991-92	1	2	4	8
1993-94	3	3	5	9
1995-96	3	4	1	9
1997-98	1	4	3	8
Total	10	18	21	47

ANNEX VII. Supplemental budget requirements for EARSAM
research activities (1989-1991)

Country	Year 1	Year 2	Year 3	Total
	US dollars			
Burundi	20,000	25,000	30,000	75,000
Ethiopia	64,530	49,266	36,070	149,866
Kenya	45,000	50,000	55,000	150,000
Rwanda	30,000	35,000	40,000	105,000
Somalia	55,000	60,000	65,000	180,000
Sudan	60,000	70,000	80,000	210,000
Tanzania	50,000	60,000	40,000	150,000
Uganda	53,180	60,000	74,240	188,420
Total	377,710	409,266	420,310	1,217,886

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