Organization of African Unity
Scientific, Technical and Research Commission
(OAU/STRC)

Joint Project 31: Semi-Arid Food Grain Research and Development
SAFGRAD II

Maize and Cowpea Collaborative Research Networks for West and Central Africa

ANNUAL REPORT
1992/93

Funded by: United States Agency for International Development
(USAID)

International Institute of Tropical Agriculture
Oyo Road
PMB 5320
Ibadan, Nigeria

September, 1993

CONTENTS

Preface

This report covers the activities of the IITA/SAFGRAD Project on Maize and Cowpea Collaborative Research Networks for West and Central Africa for the period April 1, 1992 to March 31, 1993.

During this period, the activities of the Networks were implemented by national programs of member countries according to the programs developed by their respective Steering Committees which met in May 1992 to monitor and review the progress of project implementation.

Abbreviations

ACPO	Accelerated Crop Production Officer.
BRA	Bureau de Recherche Agronomique, Tchad.
CIMMYT	Centro International de Mejoramiento de Maiz y Trigo.
CIRAD	Centre de Coopération International en Recherche Agronomique pour le Développement.
CORAF	Conférence des Responsables de la Recherche Agronomique Africains et Français.
CRPA	Centre Régional de Production Agro-Pastorale.
DPV	Direction de la Production Végétale.
GLIP	Grain Legume Improvement Program, IITA.
IARC	International Agricultural Research Center.
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics.
IDR	Institut de Développement Rural.
IDRC	International Development Research Center.
IITA	International Institute of Tropical Agriculture.
INERA	Institut d'Etudes et de Recherches Agricoles.
INRAN	Institut National de Recherches Agronomiques du Niger.
NARS	National Agricultural Research Systems.
RENACO	Réseau Niébé d'Afrique Centrale et Occidentale. (West and Central Africa Cowpea Network).
SAFGRAD	Semi-Arid Food Grain Research and Development.
SCO	SAFGRAD Coordination Office, Ouagadougou.
USAID	United States Agency for International Development.
WECAMAN	West and Central Africa Maize Network.

Acknowledgements

The IITA/SAFGRAD project gratefully acknowledges the continued support from the Government and people of Burkina Faso. In particular, the Ministry of Higher Education and Scientific Research assisted through its "Centre National de Recherches Scientifique et Technologiques", in providing land and other facilities at Kamboinse, Saria, Farako-Bâ and Kouare Stations. Land provided by the Ministry of Agriculture at Loumbila and Pobe (Djibo) enabled the provision of the necessary technical support to sustain the Networks' collaborative activities. The excellent cooperation of the Director of the "Institut d'Etudes et de Recherches Agricoles" (INERA), Heads of Research Stations, and the Directors of the "Direction de la Production Végétale (DPV)" facilitated the successful execution of Network activities.

Enthusiastic support from the Directors of Agricultural Research in the National Agricultural Research Systems (NARS) of the Networks member countries is gratefully acknowledged. The active participation of researchers of the National Maize and Cowpea Programs contributed largely to the successful operation of these Networks.

The Project commends the logistic support received from the SAFGRAD Coordination Office, especially in facilitating effective communication with NARS. Prompt and effective administrative and technical backstopping from IITA Heaquarters at Ibadan, Nigeria, played a significant role in the successful implementation of the programs of the Collaborative Research Networks.

Other IARCs and organizations namely CIMMYT, ICRISAT, CIRAD, IDR (University of Ouagadougou) and Many CRPA Directors, ACPO Program in Togo, IDRC through INERA/Burkina Faso and USAID/ Burkina Faso co-operated fully with this project.

Finally, the IITA/SAFGRAD Project deeply appreciates the allocation of funds by the United States Agency for International Development (USAID) which fully financed the project activites presented in this report.

Ouagadougou
September, 1993

Nyanguila Muleba
Project Leader &
Coordinator, Cowpea
Research Network.

Declaration

Mention of a particular pesticide, any other chemicals or products in this document does not imply endorsement of, or discrimination against any manufactured products by IITA/SAFGRAD.

IITA/SAFGRAD PERSONNEL

Principal Staff

Dr. J.M. Fajemisin	Maize Network Coordinator & Project Leader, IITA/SAFGRAD up to May, 1992.
Dr. N. Muleba	Cowpea Network Coordinator & Project Leader, IITA/SAFGRAD from June 1992.
Dr. Baffour Badu-Apraku	Replaced Dr. Fajemisin as Maize Network Coordinator in May 1992

Support Staff

Mrs. Rachel Ouedraogo	Secretary
Mr. Kamboke Ben Morgan	Bilingual Secretary
Miss. Aminata Bohena	Secretary, up to April, 1992.
Mr. Raymond Sanduidi	Field Technician (Maize) up to December 1992.
Mr. Victor Tapsoba	Field Technician (Cowpea)
Mr. Waongo Yoro	Field Technician (Maize) beginning June, 1993
Mr. Joseph Bationo	Field Assistant (Maize)
Mr. Seydou Ouedraogo	Driver-Mechanic
Mr. Martin N. Akpaloo	Driver-Mechanic, up to December, 1992.
Mr. Daniel Ouedraogo	Office boy
Miss. Irène Sam	Accountant, from May, 1992.

Executive Summary

This report covers the period of April 1, 1992 to March 31, 1993. During this period the steering committees of both maize and cowpea networks met once: May 19-21 in Ouagadougou to plan for networks' activities for the 1993 crop season. The November meeting, during which, the networks' achievements for the season are reviewed and discussed was not convened because of lack of funding. The activities of the maize and cowpea networks are summarized as follows:

Maize Network

During the May's meeting, the Steering Committee reviewed the progress on collaborative research, the results of the regional trials and planned the network activities for 1992. Also, the technical format and approaches for the impact asssessment of the maize network were discussed and several suggestions were made by the Steering Committee.

The Lead Centers continued to implement assigned collaborative research projects during the period under review. The maize network provided funds to lead centers in support of the collaborative research projects. Also, the technology adapting NARS were allocated supplemental funds to strengthen the adaptive research and seed production activities.

The resident research activities continued to be a major preoccupation of the network coordinator. Emphasis was placed on the development of early maturing, drought tolerant varieties, extra-early varieties, varietal maintenance and seed increase of the entries in the regional trials. Also, the coordinator spent considerable effort on the documentation of the network performance and served as a resource person for the SAFGRAD impact assessment study.

The Regional Uniform Variety Trials (RUVT) served as the main vehicle for the exchange of technonologies among network member countries. Forty-one and thirty sets of the early and extra-early variety trials, respectively, were dispatched to 18 member-countries in West and Central Africa. Data were received from 57 sets from 14 countries, giving a recovery rate of 73%.

The results of the 1992 regional trials confirmed that high yielding early and extra-early maize varieties with good adaptation to the Sudan and Guinea savanna zones of West and Central Africa are now available. It is therefore recommended that national programs should 'push' the varieties to their farmers for adoption to fill the hunger gap in July/August in the semi-arid zone.

The results of the SAFGRAD impact assessment showed that the maize network had been successful in stimulating the capacity and intiative of national scientists to solve maize production problems. Both the number and types of experiments carried out by national scientists on-station and on-farm had more than doubled.

Cowpea Network

During the May's meeting, the cowpea steering committee reviewed research workplans and planned network activities of the year. It also reviewed and discussed the workplans for the USAID-SAFGRAD Impact Assessment study; and made pertinent recommendations to be followed by both network coordinator and the study team.

Although annual progress reports were not received from two Network Lead Centers, Niger and Senegal and two Associate Centers, Benin and Mali; it was gratifying to note that collaborative research conducted by Burkina Faso, Cameroon, Ghana and Nigeria covered all aspects of cowpea improvement. Research findings covered, therefore, cowpea breeding, agronomy, pathology and entomology.

With regards to cowpea breeding, new cultivars have been developed with better adaptation, high yield and *Striga* resistance: Waongo-1, Waongo-2, KVx420-7, KVx420-8, KVx420-4, and KVx426-4; insect pest tolerance and wide adaptation: KVx404-8-1, KVx414-22-2, KVx414-22-9, KVx414-22-72, KVx421-25, KVx428-9 and KVx421-2J. For cowpea pathology, two cultivars: IAR4/48/51-1 and IT82D-849 were found to combine resistance to scab (*Elsinoe phaseoli*) and septoria leaf spot (*Septoria vignae* and *S. vignicola*). It should be noted also that cultivar IT82D-849 is *Striga* resistant and also has good resistance to aphids borne cowpea mosaic virus.

The regional *Striga* resistance trial dispatched to NARS in 1991 was repeated in 1992. Two cultivars: KVx402-19-1 and KVx402-19-5 exhibited better adaptation, high yield and good *Striga* resistance, as did other known *Striga* resistant checks: B301 and IT82D-849, across locations. They were fully confirmed to be improved *Striga* resistant cultivars.

The USAID-SAFGRAD Impact Assessment study team recognized that the cowpea network has been successful in stimulating the initiative and capacity of national scientists of the region to solve cowpea production constraints themselves. This was demonstrated by the increased technology development research conducted by the network Lead Centers as well as the increased adaptive research conducted by all member-countries. As a result, new technologies have been released and adopted by farmers; hence farmers increased production, productivity and income.

Support to NARS, major problems ecountered and follow up activities for 1993 are discussed in this report.

INTRODUCTION

A major crop failure experienced by the Semi-Arid sub-Saharan African Region for three consecutive years (1973-1975) as a result of severe drought led to a drastic food shortage, thereby creating long periods of famine, starvation and death of several thousands of people and livestock. This compelled African Governments to discuss ways and means of minimizing risks associated with drought in order to alleviate human suffering.

A unanimous decision was reached at the meeting by the Ministers to establish the Semi-Arid Food Grains Research and Development (SAFGRAD) Project in 1976. The idea was endorsed by the respective heads of states of the Organization of African Unity (OAU). The United States Agency for International Development (USAID) agreed to fund the project in 1978, under the auspices of the Scientific, Technical and Research Commission of the Organization of African Unity (OAU/STRC). The International Institute of Tropical Agriculture (IITA) was assigned the responsibility for regionally-oriented research activities for maize and cowpea while the International Crop Research Institute for Semi-Arid Tropics (ICRISAT) accepted responsibility for research on sorghum, millet and groundnuts. Purdue University, USA handled the farming systems research component.

The main objectives of the SAFGRAD project were:

- To coordinate agricultural research activities in the African sub-saharan semi-arid zone.

- Through resident research for maize, cowpea, sorghum, millet and groundnuts identify crop production constraints, and develop technologies to overcome the constraints.

- To ensure scientific information and technology exchange among member-countries.

- To accelerate transfer of technologies to farmers in order to ensure food security and/or increased productivity, production and income.

The maize and cowpea resident research was conducted in Burkina Faso from 1979-1987 and 1977-1987, respectively. From the research activities, it was found that:

- The growing seasons of West Africa had become shorter by 15-30 days, accompanied by erratic and poorly distributed rainfall during each month of the crop season with perhaps the exception of the months of July, August and early part of September in certain ecological zones.

- Due to this reduction in the duration of the crop season, most of the West African landraces which were photoperiod sensitive had completely lost their adaptation.

- New technologies and research methodologies to overcome the related constraints, namely drought, *Striga* problems, etc., had been developed and were ready for adoption by national programs.

The West and Central Africa maize and cowpea collaborative research networks were established as part of SAFGRAD Phase II. The networks cover 18 member countries and were initiated by the Directors of Agricultural Research of National Agricultural Research System (NARS) of the countries involved. The initiatve was taken so that they could take advantage of the laudable research breakthrough of the IITA-SAFGRAD Maize and Cowpea Resident Research activities carried out from 1977-1987. The strategy was to pool resources together in order to tackle and solve common maize and cowpea production constraints in the sub-region by sharing experience, available scientific information and new technologies to ensure food security and/or increased production of the two crops in the respective member countries.

Initially, the SAFGRAD Phase II project was to wind-up in September, 1991, but was extended thrice, from October to December, 1991, from January 1992 to December, 1992 and from January 1993 to March, 1993. This was to permit the USAID/SAFGRAD evaluation team to assess the impact of the SAFGRAD project on agricultural research, production and productivity, as well as farmers' incomes in member countries.

This report highlights the following aspects of each network.

- Collaborating national program scientists.
- Management of networks.
- Strengthening national programs.
- SAFGRAD Impact Assessment Study findings.
- Major problems encountered.
- Recommendations for improvement and follow-up activities.

For more details, questions or clarification, please address your enquiries to either the respective Network Coordinator or the crop commodity National Coordinator of the respective member-countries.

SECTION A

1.0. Collaborating National Programs and National Project Coordinators

Based on comparative advantage, cost effectiveness and the interests of the 17 members of the Maize Network, collaborative research projects were assigned to relatively strong national programs (lead centers) in 1987 by the steering committee of the Network. Scientific information and technologies emanating from the collaborative research have been shared with other member countries especially the technology adapting NARS. The Maize Network Coordinator provided by IITA implemented and coordinated the decisions of the steering committee and arranged for backstopping of network activities by the technical programs at IITA headquarters.

The Network lead and technology adapting centers in 1992/93 were as follows:

1.1. Maize Network Lead Centers

1. Burkina Faso
   - Research responsibilities: Breeding for early and extra-early maize and for drought resistance/tolerance
   - Project Coordinator : Mr. Hema Idrissa
     Station de Kamboinse
     INERA
     B.P. 7192, Ouagadougou

2. Cameroon
   - Research responsibilities : (i) Breeding for maize of different maturities, drought resistance/tolerance and *Striga* tolerance (ii) Agronomy
   - Project Coordinator : Dr. Charles Thé
     IRA/NCRE
     B.P. 2067, Yaoundé

3. Côte D'Ivoire
   - Research responsibilities : Breeding for *Striga* tolerance, stem borer resistance and for maize of different maturities.
   - Project Coordinator : Mr. Attiey Koffi
     IDESSA
     B.P. 633, Bouaké

4. Ghana
   - Research responsibilities : Breeding for maize of different maturities, streak resistance, nitrogen-use efficiency, *Striga* tolerance.
   - Project Coordinator: Dr. P.Y.K. Sallah
     Crops Research Institute
     P.O. Box 3785, Kumasi

5. Nigeria
   - Research responsibilities : Agronomy
   - Project Coordinator : Dr. E.N.O. Iwuafor
     Institute of Agric. Research, Samaru
     PMB 1044, Zaria

6. Togo
   - Research responsibilities : Development of streak resistance screening facilities and breeding for streak resistant and *Striga* tolerant varieties.
   - Project Coordinator : Dr. Esseh-Yovo Mawule
     DRA, P.P. 2318, Lomé

1.2. Technology Adapting Centers

Benin :
Mr. Romuald A. Dossou
Station d'Ina
B.P. 3, N'Dali

Cape Verde :
Mr. Carlos Silva
INIA, B.P. 50, Praia

Central African Republic:
Directeur de la Coordination Agricole
Ministère du Développement Rural
B.P. 786, Bangui

Gambia :
Mr. Musa S. Mbenga
Sapu Agric. Station
Dept of Agricultural Research
Sapu

Guinea :
Mr. Sekouna Camara
Centre Agronomique de Kilissi
IRAG, B.P. 576, Conakry

Guinée-Bissau :	Mme Isabel Miranda C.P. 71, Bissau
Mali :	Mr. NTji Coulibaly Station de Sotuba, B.P. 438 Bamako
Mauritania :	Mr. Sidi R'Chid CNRADA, B.P. 22, Kaedi
Niger :	Mr. Jika Naino INRAN, B.P. 429, Niamey
Senegal :	Mr. Abdou Ndiaye ISRA, B.P. 240 CRA/Fleuve Saint Louis
Tchad :	Chef du Bureau de la Recherche Agronomique Ministère de l'Agriculture B.P. 441, N'Djamena

2.0. Network Management

The activities of the Network during the period under review were planned and monitored by the Steering Committee. The eleventh Steering Committee meeting was held during the period.

2.1. Eleventh Steering Committee Meeting

The eleventh biannual meeting of the Maize Steering Committee took place on May 19-21 in Ouagadougou, Burkina Faso. The opening session was addressed by the SAFGRAD International Coordinator, the representative of USAID and the IITA Deputy Director General (International Cooperation).

The following people were in attendance:

- Members of the Steering Committee
  Dr. Charles Thé (Cameroon) --Chairman
  Dr. P.Y.K. Sallah (Ghana) --English Secretary
  Mr. Ntji Coulibaly (Mali) --French Secretary
  Dr. E.N.O. Iwuafor (Nigeria)

Mr. Abdou Ndiaye (Senegal)

Mr. Romuald A. Dossou (Benin)

Dr. J.M. Fajemisin --Network Coordinator (out-going)

Dr. B. Badu-Apraku --Network Coordinator (in-coming).

- Observers and resource persons

Dr. T. Bezuneh (Director of Research, SAFGRAD, Ouagadougou, Burkina Faso)

Dr. S.K. Kim (Maize Breeder, Maize Research Program, IITA, Ibadan, Nigeria)

Mr. E.F. Deganus (Special Projects' Coordinator, International Cooperation IITA, Ibadan, Nigeria)

Dr. J.M. Menyonga (SAFGRAD International Coordinator)

Dr. A.C. Schroeder (USAID Consultant for Impact Assessment Study).

The following items of the agenda were discussed at the meeting:

(i) Network Coordinator's report,

(ii) Progress reports on collaborative projects by Steering Committee members,

(iii) Discussion on Network's impact assessment studies,

(iv) Discusssion on ways to sustain network activities.

Highlights of the Steering Committee meeting

1. It was indicated that USAID had made available funds for network activities for the period April to December 1992 but at a reduced level.

2. Results of the regional trials over the past four years showed that there were Pool 16 DT SR varieties which significantly out-yielded SAFITA-2. Pool 16 DT SR varieties were in addition streak resistant whereas SAFITA-2 was not. It was therefore recommended that all countries that had already released SAFITA-2 should consider replacing it with either Kamboinse 88 Pool 16 DT SR or Farako-Bâ 88 Pool 16 DT SR (HD) in order to ensure yield stability.

3. It was announced that the Maize Network Coordinator, Dr. J.M. Fajemisin had been recalled by IITA to head IITA-Station in the Côte D'Ivoire and would therefore leave the network at the end of May. Dr. B. Badu-Apraku from the Ghana maize program had been appointed as the new coordinator to replace Dr. Fajemisin.

4. The Steering Committee decided that populations that had been developed for improvement in resistance to drought or experimental varieties derived from such populations should be designated "DT" instead of "DR". This change was necessary since "DR" designation could be misinterpreted to mean that the materials are resistant to drought, which is not the case at this stage.

5. IITA borer resistant (BR) materials evaluated in Cameroon and Ghana for resistance to *Eldana saccharina* and *Sesamia calamistis* did not show resistance in the two countries. However, new inbred lines with good levels of resistance to *Sesamia* have been identified by IITA and efforts are being made to improve the level of resistance so that borer resistant hybrids and synthetics could be developed.

6. IITA Maize Program continued to provide effective backstopping to the Maize Network. Apart from germplasm and trials sent to national programs, IITA maize scientists paid consultation visits to several national programs. Also, Dr. Yovo Mawule,

the former chairman of the Steering Committee and head of the maize program of Togo joined IITA in April as a visiting scientist for a year.

Recommendations

The Steering Committee after its deliberations came up with the following recommendations.

1. In view of the various pertinent recommendations which have been made by the Steering Committees and which have not been followed through, it was recommended that the SAFGRAD Coordination Office should make an extra effort to ensure that the recommendations are implemented.

2. Considering the problem of loss of valuable breeding materials in many national programs in the sub-region, it was recommended that the Network should assist national programs to upgrade their storage facilities.

3. To promote and sustain the present level of collaboration among NARS in West and Central Africa, it was recommended that the present system of exchange of visits by NARS scientists should be continued.

3.0. Strengthening National Programs

During the eleventh Steering Committee meeting, it was decided that in view of the limited funds available for the extension of the SAFGRAD Project, the Network should concentrate on the following activities in 1992 in an effort to strengthen the national programs:

(1) Regional Trials
(2) Collaborative research activities
(3) Resident research activities
(4) Provision of financial assistance to national programs

(5) Publication of research results and

(6) Network Impact Assessment Study.

This annual report therefore covers these five areas of emphasis.

3.1. Regional Trials

Two types of Regional Uniform Variety Trials (RUVT) were offered in 1992 to collaborators in West and Central Africa covered by the SAFGRAD Maize Network. These included:

- RUVT-Early : Early maturing varieties flowering in about 50 days after planting and producing dry grains in 90-95 days.

- RUVT Extra-Early : Extra-early maturing varieties flowering in 40-45 days after planting and producing dry grains in about 80 days.

The composition of each trial is presented in Tables 1 and 2. A randomized complete block design with four replications per site was employed for all the trials. A plot consisted of four 5-metre rows spaced 0.75 m between the rows with within-row spacing of 40 cm. There were 2 plants/stand resulting in a population density of 66,666 plants/ha. Data were recorded on only the two central rows.

A total of 78 sets of RUVT were sent to 18 countries. Further details are shown in Table 3. As at the end of April, 1993, data had been received from 57 sets from 14 countries giving a recovery rate of 73%. Feedback received from Mauritania indicated that excess rainfall and termite damage had led to crop failure. No data were returned by the Gambia, Central Africa Republic and Guinea Bissau.

Table 1. Description of entries in RUVT Early, 1992.

ENTRY No	Name	PROPOSED BY	PARENTAGE	GRAIN TYPE
1	FARAKO-BA 88 POOL 16 DT	SAFGRAD	Pool 16 (Tropical Early White Dent)	White-dent
2	KAMBOINSE 88 POOL 16 DT	SAFGRAD	" "	White-dent
3	ACROSS 90 POOL 16 DT	SAFGRAD/NARS	" "	White-dent
4	FARAKO-BA 90 POOL 16 DT (HD)	SAFGRAD/BURKINA	" "	White-dent
5	INA 90 POOL 16 DT	SAFGRAD/BENIN	" "	White-dent
6	KAMBOINSE 90 POOL 16 DT	SAFGRAD/BURKINA	" "	White-dent
7	MAROUA 90 POOL 16 DT	SAFGRAD/CAMEROON	" "	White-dent
8	NYANKPALA 90 POOL 16 DT	SAFGRAD/GHANA	" "	White-dent
9	BDP-SR BC3 F4	SAFGRAD/BENIN	BDP (local variety from Benin), SR donor	White flint
10	FBC 6	BURKINA FASO	A Composite of DMR-ESRY, Rod 6, Rod 12, Revolution précoce, FBC4, Maka, IRAT 217 and TZESR-Y C2.	Yellow semi-flint
11	IKENNE 88 BU-ESR-W	IITA	Back-up pool of early maturing germplasm	White semi-dent
12	MAKA-SR BC3 F4	SAFGRAD/ MAURITANIA	Maka (from Mauritania), SR Donor	Yellow semi-flint
13	TZESR-W-SE	IITA	TZESR-W, Floury gene donor	White floury
14	SAFITA-2 (RE)	SAFGRAD	Pool 16 (Tropical Early White-Dent)	White-dent
15	CHECK	-	Various	Various

Table 2. Description of entries in RUVT Extra-Early, 1992.

ENTRY No.	Name	PROPOSED BY	PARENTAGE	GRAIN TYPE
1	CSP-SR BC3 F4	IITA-SAFGRAD	Compuesto Selection Precoz, SR source	Yellow flint
2	TZEE-W-SR BC3 F4	" "	Local & introduced germplasm, SR source	White semi-dent
3	TZEE-Y-SR BC3 F3	" "	Local & introduced germplasm, SR source	Yellow flint
4	TZESR-W X GUA 314	" "	TZESRW x Columbian germplasm	White flint
5	CSP	" "	Compuesto Selection Precoz	Yellow flint
6	TZEE-W	" "	Local & introduced germplasm	White semi-dent
7	TZEE-Y	" "	Local & introduced germplasm	Yellow flint
8	CSP X L. RAYTIRI	" "	CSP X Local variety	Yellow flint
9	TZEF-Y	" "	Local & introduced germplasm	Yellow flint
10	CHECK	Collaborator	Various	Various

Table 3. Number of sets of Regional Uniform Variety Trials (RUVT) requested by NARS in 1992 and data recovery.

COUNTRY	NUMBER OF TRIALS REQUESTED		
	RUVT-EARLY	RUVT EXTRA-EARLY	TOTAL
BENIN	3	2	5
BURKINA FASO	3	3	6
CAMEROON	3	3	6
CAPE VERDE	1	0	1
CENTRAL AFRICAN REPUBLIC	3	2	5
COTE D'IVOIRE	3	3	6
GAMBIA	2	2	4
GHANA	2	3	5
GUINEA	3	-	3
GUINEA BISSAU	2	3	5
MALI	2	3	5
MAURITANIA	1	1	2
NIGER	2	1	3
NIGERIA	3	3	6
SENEGAL	2	2	4
SIERRA LEONE	2	2	4
TCHAD	2	2	4
TOGO	2	2	4
TOTAL RETURNED	31	26	57
TOTAL DISPATCHED	41	37	78
RECOVERY RATE (%)	76	70	73

The precision level of both RUVT-early and RUVT extra-early continued to be reasonably high with 77% of the trials having CV values of 25% or less. Grain yield and other important agronomic characters recorded at the individual locations as well as the across-location analyses for the locations with CV values of 26% or less are presented in Tables 4 and 5 for the early and extra-early varieties, respectively.

Results of the individual location analyses of grain yield of the early and extra-early maturing varieties showed high grain yields in all locations. It is interesting to note the exceptionally high grain yield produced by the extra-early varieties at Garoua and Soucoundou (Cameroon), Farako-Bâ (Burkina Faso), and Sotuba (Mali). This is a clear demonstration of the high yield potential of the extra-early varieties under favorable growing conditions.

The across-location analyses of grain yield of the early maturing varieties revealed Across 90 Pool 16 DT as the highest yielding entry and BDP-SR BC3 F4 as the lowest yielder. However, no differences were detected among the first four top yielders. It is interesting to note that several versions of Pool 16 DT significantly out-yielded SAFITA-2, a streak susceptible check extracted from Pool 16. This confirms the earlier findings and emphasizes the need for all countries which have released SAFITA-2 to replace it with one of the streak resistant versions of Pool 16 DT in order to ensure yield stability.

In general, the varieties from Pool 16 DT were earlier maturing and shorter than the other varieties. The variety BDP-SR BC3 was not only the lowest yielder but also, the latest maturing and the tallest. Maka-SR BC3 F4 was also late and tall.

Table 4. Grain yield (t/ha at 15% moisture) of varieties tested in RUVT Early trial in 1992 at 17 locations in 10 countries and across-location means for days to 50% silking, plant stand, plant height, ear height, and the number of plants and ears harvested.

VARIETIES	LOCATIONS								
	BENIN		BURKINA FASO		COTE D'IVOIRE	GUINEE CKRY	GHANA		
	1	2	3	4	5	6	7	8	9
2 KAMBOINSE 88 POOL 16 DT	4.67	5.71	6.60	4.76	3.75	5.30	4.35	3.78	4.59
3 ACROSS 90 POOL 16 DT	4.59	5.50	6.59	4.73	3.70	4.98	4.31	3.77	4.58
11 IKENNE 88 BU-ESR-W	3.90	4.76	5.70	4.30	3.21	4.67	4.07	3.27	4.16
1 FARAKO-BA 88 POOL 16 DT(HD)	4.88	5.87	7.05	4.92	3.85	5.30	4.41	3.89	4.68
9 BDP-SR BC3 F4	4.13	4.89	6.03	4.43	3.34	4.75	4.10	3.37	4.24
7 MAROUA 90 POOL 16 DT	4.28	5.01	6.22	4.53	4.45	4.77	4.16	3.48	4.32
10 FBC 6	3.95	4.76	5.72	4.30	3.32	4.75	4.09	3.33	4.23
4 FARAKO-BA 90 POOL 16 DT(HD)	4.50	5.15	6.34	4.61	3.70	4.91	4.29	3.75	4.57
14 SAFITA-2 (RE)	3.38	4.15	5.30	4.17	2.64	3.71	3.85	3.25	3.97
8 NYANKPALA 90 POOL 16 DT	3.25	4.90	6.16	4.47	3.34	4.77	4.10	3.44	4.26
5 INA 90 POOL 16 DT	4.39	5.04	6.34	4.61	3.63	4.85	4.23	3.67	4.54
6 KAMBOINSE 90 POOL 16 DT	4.34	5.03	6.31	4.61	3.61	4.85	4.17	3.50	4.51
15 EARLY THAI	3.18	3.90	5.10	4.04	1.13	3.52	3.50	2.27	3.78
13 TZESR-W-SE	3.57	4.57	5.40	4.23	3.09	4.18	4.04	3.25	4.06
12 MAKA-SR BC3 F4	3.58	4.59	5.69	4.25	3.10	4.32	4.07	3.27	4.11
LSD 5%	1067	939.9	978	NS	690.9	506.1	696.6	847.3	677.4
PROB. OF F	0.071	0.009	0.011	0.028	0.000	0.000	-	0.239	0.270
COEFF. OF VARIATION	18.2	13.4	11.4	16.6	14.9	7.7	11.9	17.3	11.0

Location codes: 1 = Angaradebou, 2 = SRCV-Ina, 3 = Farako-Bâ , 4 = Kamboinse, 5 = Bouaké, 6 = CRA Kilissi, 7 = Manga-Bawku, 8 = Nyankpala, 9 = Wa, 10 = Kita 11 = Sotuba, 12 = Bengou, 13 = Nioro du RIP, 14 = Dougui, 15 = Gassi, 16 = Broukou, 17 = Tantiegou.

Table 4. (Cont'd)

VARIETIES	LOCATIONS							
	MALI		NIGER	SENEGAL	TCHAD		TOGO	
	10	11	12	13	14	15	16	17
2 KAMBOINSE 88 POOL 16 DT	3.96	8.10	3.38	3.97	3.56	5.34	4.26	5.92
3 ACROSS 90 POOL 16 DT	3.76	8.06	3.25	3.85	3.34	5.04	4.21	5.15
11 IKENNE 88 BU-ESR-W	3.36	7.08	2.28	3.51	2.56	4.27	3.76	4.24
1 FARAKO-BA 88 POOL 16 DT(HD)	4.45	8.64	3.85	4.05	3.75	5.48	4.32	6.21
9 BDP-SR BC3 F4	3.49	7.38	2.51	3.64	2.69	4.59	3.84	4.32
7 MAROUA 90 POOL 16 DT	3.61	7.39	2.66	3.74	2.76	4.81	3.92	4.53
10 FBC 6	3.47	7.27	2.37	3.64	2.68	4.31	3.79	4.29
4 FARAKO-BA 90 POOL 16 DT(HD)	3.75	7.73	2.96	3.82	3.23	5.00	4.13	4.93
14 SAFITA-2 (RE)	3.15	6.47	2.21	3.23	2.34	2.97	3.47	3.57
8 NYANKPALA 90 POOL 16 DT	3.61	7.38	2.61	3.72	2.70	4.70	3.84	4.32
5 INA 90 POOL 16 DT	3.73	7.67	2.87	3.79	2.85	4.94	4.03	4.93
6 KAMBOINSE 90 POOL 16 DT	3.70	7.46	2.80	3.76	2.85	4.81	4.00	4.80
15 EARLY THAI	2.24	5.62	2.19	2.73	1.68	2.58	3.39	2.75
13 TZESR-W-SE	3.15	6.74	2.32	3.25	2.45	3.24	3.68	3.60
12 MAKA-SR BC3 F4	3.15	6.91	2.25	3.43	2.45	3.96	3.84	3.84
LSD 5%	901.2	1006	902	1149	1.089	793.3	528.8	348.5
PROB. OF F	0.036	0.000	0.014	-	0.000	0.001	0.024	0.000
COEFF. OF VARIATION	19.4	9.6	23.4	22.3	17.3	19.9	9.5	54

Location codes: 1 = Angaradebou, 2 = SRCV-INA, 3 = Farako-Bâ, 4 = Kamboinsé, 5 = Bouaké, 6 = CRA-Kilissi, 7 = Manga-Bawku, 8 = Nyankpala, 9 = Wa, 10 = Kita, 11 = Sotuba, 12 = Bengou, 13 = Nioro du RIP, 14 = Dougui, 15 = Gassi, 16 = Broukou, 17 = Tantiegou.

Table 4. (cont'd).

VARIETIES	VARIETY MEAN						
	GRAIN YIELD (t/ha)	50% SILK (days)	PL. ST (cm)	PL. HT (cm)	E. HT (cm)	P. HARV ('000/ha)	E. HARV ('000/ha)
3 ACROSS 90 POOL 16 DT	4498	53	43	167	76	46	45
11 IKENNE 88 BU-ESR-W	4496	54	43	173	76	47	45
8 NYANKPALA 90 POOL 16 DT	4491	53	44	173	82	47	46
2 KAMBOINSE 88 POOL 16 DT	4453	53	43	172	81	46	45
7 MAROUA 90 POOL 16 DT	4434	52	43	165	76	47	46
5 INA 90 POOL 16 DT	4277	52	44	170	78	47	45
4 FARAKO-BA 90 POOL 16 DT(HD)	4268	53	43	168	76	47	45
12 MAKA-SR BC3 F4	4265	55	43	183	88	46	44
10 FBC 6	4192	56	43	188	91	46	42
6 KAMBOINSE 90 POOL 16 DT	4175	52	44	163	73	47	45
1 FARAKO-BA 88 POOL 16 DT(HD)	4162	53	43	166	73	46	43
14 SAFITA-2 (RE)	4116	53	44	164	75	46	45
13 TZESR-W-SE	3968	54	43	170	77	46	43
15 CHECK	3863	54	40	164	74	42	39
9 BDP-SR BC3 F4	3856	54	43	191	97	47	45
LSD 5%	204.7	0.6	0.9	4.3	3.5	1.1	1.4
PROB. OF F	0.00	0.00	0.00	0.00	0.00	0.00	0.00
COEFF. OF VARIATION	14.4	3.4	6.5	7.4	13.2	7.3	9.6

Table 5. Grain yield (t/ha at 15% moisture) of varieties tested in RUVT Extra-Early trial in 1992 at 12 locations in 7 countries and across-location means for days to 50% silking, plant height, ear height, and the number of plants and ears harvested.

VARIETIES	LOCATIONS											
	TOGO		BURKINA FASO	GHANA			MALI		TCHAD	BENIN	CAMEROON	
	1	2	3	4	5	6	7	8	9	10	11	12
4 TZESR X GUA 314	3893	3520	6007	3351	2948	3467	3520	6458	2867	2323	6181	4019
5 CSP	3760	3707	5016	2890	3386	3077	4053	6835	2653	2930	5921	4405
2 TZEE-W-SR BC3 F4	3547	3467	5477	3108	3565	3835	3520	7137	3360	3518	6161	3880
8 CSP X L. RAYTIRI	3493	4053	4969	2993	2932	2889	3706	6413	3080	2644	5957	5099
9 TZEF-Y	3440	3673	4787	3333	2837	3016	3973	6123	2827	2066	5646	4831
1 CSP-SR BC3 F4	3360	4347	4740	3464	3329	3518	4347	6111	2667	2829	5821	3964
3 TZEE-Y-SR BC3 F4	3093	3387	4284	3691	2424	2155	2960	5017	2867	2544	4801	4174
10 CHECK	2907	2960	3217	3728	4144	4579	3386	5589	2680	2579	6103	4245
6 TZEE-Y	2640	3333	2991	2882	2471	2247	3307	4295	2493	3223	4328	4036
7 TZEE-Y	2427	3307	3563	3067	2372	1747	3333	5073	2920	2301	4229	4109
LSD 5%	705.7	773.7	927.9	381.6	548.7	735.6	1068	943.4	711.1	940.0	1283	1146.0
PROB. OF F.	0.003	0.037	0.000	0.000	0.000	0.000	0.356	0.000	0.041	0.103	0.012	0.004
COEFF. OF VARIATION	14.9	14.8	14.2	8.1	12.4	16.6	17.2	11.0	17.1	24.0	16.3	14.3

Location codes: 1 = Broukou, 2 = Tantiegou, 3 = Farako-Bâ, 4 = Nyankpala, 5 = Manga-Bawku, 6 = Wa, 7 = Massantola, 8 = Sotuba, 9 = Dougui, 10 = Angaradebou, 11 = Garoua, 12 = Soucoundou.

Table 5. (Cont'd).

VARIETIES	VARIETY MEAN						
	GRAIN YIELD (t/ha)	DYS. SLK (days)	PL. ST (cm)	PL. HT (cm)	E. HT (cm)	P. HARV ('000/ha)	E. HARV ('000/ha)
2 TZEE-W-SR BC3 F4	4090	47	48	160	67	47	45
4 TZESR-W X GUA 314 BC1 F7	3885	49	46	153	59	44	42
5 CSP	3866	47	47	143	50	45	44
8 CSP X L. RAYTIRI	3857	46	48	155	57	45	43
1 CSP-SR BC3 F4	3833	47	48	138	50	46	45
9 TZEF-Y	3724	47	48	153	62	47	45
10 CHECK	3663	50	48	168	75	45	42
3 TZEE-Y SR BC3 F4	3381	46	47	143	56	45	43
7 TZEE-Y	3089	42	47	140	51	44	42
6 TZEE-W	3061	45	48	143	59	45	45
LSD 5%	242.1	1.7	1.9	6.0	4.0	2.0	2.1
PROB. OF F	0.000	0.157	0.184	0.000	0.000	0.021	0.001
COEFF. OF VARIATION	15.1	8.4	9.2	9.1	15.3	9.3	11.0

Results of the combined analyses of grain yield of the extra-early varieties showed TZEE-SR BC3 F4 as the highest yielding variety and TZEE-W as the lowest yielder. The streak resistant varieties, TZEE-W-SR BC3 F4 and TZEE-Y SR BC3 F4 significantly out-yielded their streak-susceptible versions TZEE-W and TZEE-Y, respectively. However, the streak resistant versions were later maturing than their streak-susceptible counterparts. In addition TZEE-W-SR BC3 was the tallest entry. The later maturity and height of TZEE-W-SR probably accounted for its higher yield potential compared to the other entries, especially the non-SR version, TZEE-W.

The results of the 1992 regional trials have confirmed that high yielding early and extra-early maize varieties adapted to the Sudan and Northern Guinea Savanna zones of West and Central Africa are now available. In addition, agronomic practices that are compatible with the edapho-climatic peculiarities of the zones have been developed. Some of the varieties evaluated in the regional trials have already been adopted by some national programs and are in production while others are at the on-farm testing stage. The result of the use of these early and extra-early varieties is the increase in total maize production in West and Central Africa and the movement of maize into new frontiers, especially, the Sudan Savanna. It is anticipated that national programs which have already released SAFITA-2 would replace it with a streak resistant version of Pool 16 such as Kamboinse 88 Pool 16 DT or Farako-Bâ 88 Pool 16 DT (HD). This will ensure sustained improvement in maize production and productivity and eventually, food self-sufficiency in the semi-arid zone of West and Central Africa. The high yield potential demonstrated by the extra-early varieties, especially TZEE-W-SR BC3 under favorable growing conditions suggests the need for national programs to vigorously 'push' the extra-early varieties to their farmers for use in filling the hunger gap in July/August in the semi-arid zone.

The next phase of the Maize Network should place more emphasis on the promotion and adoption of extra-early varieties in member countries through on-farm testing and demonstrations.

3.2. Collaborative Research

The collaborative research projects aim at exploiting the strengths of the strong NARS (Lead Centers) for the generation of technologies which can then be shared by network member countries. During the year, the Lead Centers continued to implement research projects that have been assigned to them.

3.3. Resident Research Activities

Because of limited funding and the impact assessment study, the resident research activities were scaled down considerably. The resident research activities carried out included:

3.3.1. Development of Early Maturing Drought Tolerant Maize Varieties

One hundred and sixty half-sib families of Pool 16 DT C4 F1 were planted ear to row. Plants within families with good pollen-silk synchrony and agronomically desirable characteristics were selfed in an effort to improve the drought tolerance. In addition, the crosses between Pool 16 DT and Pool 16 Sequia, the early fractions of La Posta Sequia and Tuxpeno Sequia, were planted and selfed in an effort to introgress the superior selections into Pool 16 DT C4. The S1 families would be planted in 1993 under simulated drought conditions and plants within families with good pollen-silk synchrony would be identified and recombined to reconstitute the population.

3.3.2. Development of Extra-Early Maize Varieties

Bulked F1 seed of TZEE-W-SR BC5 and TZEE-Y-SR BC5 were planted in half sib recombination blocks in isolation and advanced to the F2 stage. The two new varieties would be made available to NARS through Regional Uniform Variety Trials for evaluation in 1993.

3.3.3 Seed Increase and Varietal Maintenance

In order to ensure that seed for 1993 trials were available, and also to satisfy requests from national programs, multiplication of the entries in the regional trials and other varieties in the program was carried out at Kamboinse.

4.0. Provision of Financial Assistance to National Programs

Financial assistance was provided to National programs as follows:

Benin	$1500	Guinea Bissau	$1000
Cameroon	$2000	Mali	$1500
Cape Verde	$1000	Mauritania	$1000
Central Afr. Rep.	$1000	Niger	$1000
Côte d'Ivoire	$1500	Nigeria	$2000
Gambia	$1000	Senegal	$1500
Ghana	$2000	Tchad	$1000
Guinea	$1000	Togo	$1500

5.0. Publication of Research Results

An important activity during the year was the documentation of Network performance. A brochure summarizing the activities and achievements of the Maize Network was prepared and distributed. Also a synthesis report on the activities carried out during phases I and II of SAFGRAD to strengthen national programs in the sub-region was edited and distributed. Lastly, a publication entitled "the performance of the early and extra-early maize varieties in West and Central Africa" was submitted for publication in the journal Discovery and Innovation.

6.0. SAFGRAD Impact Assessment Study

Since the establishment in 1987, the Maize Network has undergone the mid-term and the end of Project evaluations. Results of both evaluations indicated that the Network had achieved most of the planned outputs with evidence suggesting that most of the project purposes had been accomplished. However the end of Project evaluation team recommended an impact assessment of the Maize Network since it did not have enough information to appraise the impact of the Network. Consequently, USAID requested for an impact assessment study to be conducted on the maize network.

During the Maize Network Steering Committee meeting held between 19-22 May, 1992, the technical format and approaches for the impact assessment study were discussed and several suggestions were made by the Steering Committee to improve data collection and make the information to be derived from the impact assessment more useful. Following the Steering Committee meeting, the collection, analysis and synthesis of primary data by the Network Coordinator and the SAFGRAD Coordination Office from existing reports of the network, and from national programs were carried out.

A number of meetings were held from June-July between the Network Coordinator and the Assessment Team (composed of the SAFGRAD Director of Research, USAID research analyst and a senior economist) to review the formats for the technical data collection and to address issues in the scope of work. As a result of these efforts, the technical format for data collection were prepared and sent to twelve countries, namely, Ghana, Nigeria, Niger, Gambia, Côte d'Ivoire, Cameroon, Senegal, Mali, Guinea-Conakry, Togo, Benin and Burkina Faso. It was decided by the assessment team that although the forms for technical data collection were to be sent to NARS scientists from twelve countries, the impact assessment study would cover only Burkina Faso, Cameroon, Ghana, Niger and Mali. Priority for the data collection was therefore given to these five countries. Of the twelve countries who received the forms, only Côte d'Ivoire and Gambia did not return the completed forms.

6.1. Visits to National Programs for the Impact Assessment

The Maize and Cowpea Network coordinators joined the SAFGRAD Impact Assessment Team (comprising Dr. T. Bezuneh, A. Schroeder and J. Scott) in their visits to Burkina Faso (6/8/92), Mali (8-13/8/92), Niger (13-19/8/92) and Ghana (20-25/8/92). The team was joined by the Sorghum Network Coordinator during the visits to Mali and Niger.

The objectives of the visits were:

a) to assist the national scientists in the completion of technical data forms sent to them earlier,

b) to gather information on the adoption and utilization of technologies emanating from the network efforts, institutional changes in NARS and any other information relevant to the impact assessment.

Visit to Burkina Faso

The assessment team met with the Director General for Research, the Director of INERA, and the National Leaders of the Sorghum and Cowpea Programs on 6th August, 1992.

After brief introductory remarks by the Director General of INERA, Dr. Taye explained the objectives of the impact assessment mission. He indicated that the team was to look in more depth at the changes taking place as a result of networking activities and the impact of the technologies developed and adopted through network efforts on productivity, production and incomes. The economist, Dr. Scott added that it was necessary to determine the economic impact of SAFGRAD networks, the comparative advantage of the SAFGRAD mandate crops (maize, cowpea and sorghum), and the effect of the adoption of the technologies on incomes. The team also emphasized the fact that the outcome of the impact assessement would determine whether investments in agricultural research is justified.

The INERA team felt that the emphasis of the assessment team should be on:

a) whether varieties are available and whether there is diffusion and adoption,

b) whether technologies have been developed and if so whether they are feasible.

They expressed concern about the assessment of the networks on the basis of the impact of technologies on incomes since they felt that several factors determine this and in most cases the researchers have no control over some of these factors. The request for information on the relative importance of the different crops was also questioned since it was considered not appropriate. It was also pointed out that SAFGRAD should not have agreed to the terms of reference for the impact assessment since

the impact of research on incomes is very tricky and could even have adverse effect on research funding. They explained that it would be difficult to measure the impact of research on incomes and only indirect effect could be estimated.

The general feeling was that appropriate technologies including varieties had been developed and made available to farmers but quantitative data on adoption and the impact of technologies on incomes would not be easy to come by especially if one considered the fact that the Networks have been in existence for about five years only. However, the Director General for research promised to make available to the team documents relevant to the assessment.

On the transfer of Network leadership to NARS, the DG indicated that Burkina Faso was ready to take up the responsibility but the decision was up to SAFGRAD.

Visit to Mali

Discussions were held with the Director General of IER, Research Director and Chairman of WECASORN, Scientists at Sotuba Station, officials of the Extension services, seed multiplication agencies, World Bank Agricultural Extension Project, Institute of Sahel, the Ministry of Agricultural Planning and the Economic Unit. A set of tables for collection of economic data was made available to the ICRISAT economist for completion.

During the meeting with the Deputy Director General of Research, he briefed the team on the institutional changes that have taken place in IER since 1990. He indicated that Agricultural research has been regionalized based on the different ecological zones in the country. Multidisciplinary teams have been established for each crop based on the importance in each zone. Each regional centre has a director and a secretary. The secretary is responsible for monitoring and

evaluation. Major constraints and research needs to alleviate constraints have been identified.

The Director General indicated that although there are about 250 staff in various positions, there was still the need for training more staff and they were expecting technical assistance for this purpose. A donors conference is planned for this year to seek financial support for agricultural research. At present 40% of the agricultural research budget is borne by the government.

At the Sotuba Station, Dr. Doumbia, the cowpea entomologist, again expressed concern about the economic impact assessment of the Networks since he felt that the whole process of adoption and use of technologies depends on several factors, some of which the researchers have very little control. Also, he felt that most of the food is produced by the subsistence farmer who is more interested in meeting his food requirements and hence yield stability is his goal rather than production for commercial purpose. The scientists expressed fear about how the data being collected by the Assessment Team would be interpreted.

At the department of statistics, the team was informed that maize and cowpea varieties made available to Mali through the Networks have been adopted in the country. Data on these varieties were made available to the team.

During the meeting at the USAID office with Dr. Tadesse (Agronomist) and the Agricultural Development Officer, the team was again informed that maize and cowpea varieties like SAFITA-2 and SUVITA-2 and several others had been widely adopted by farmers. However, the problem is how to quantify the impact which is attributable to SAFGRAD since there are several players involved in the development and transfer of the technologies.

At CMDT it was reported that relationship had been established between cotton production and the production of associated crops like maize, cowpeas etc. Wherever improved technology is used for cotton, farmers also tend to use improved technology for the other crops. Relevant secondary data was made available to the assessment team.

Visit to Niger

The assessment team visited the Director General of INRAN, ICRISAT Sahelien Centre, the INRAN Kollo Station, the On-farm Research and Extension Unit of the Ministry of Agriculture, USAID/Niger, Seed Production Unit, the World Bank and the Agricultural Statistics Unit.

During the visits the team learnt the following:

1) The agricultural research and extension are being re-organized in Niger to make them more effective. The World Bank was assisting in this endeavour and is about to start a 20 m dollar Project. The Government has no money for agricultural research.

2) The USAID has spent $41m in 17 years on three Projects, namely cereal production, cereal research and applied agricultural research. Several staff have been trained under these projects. The basic interest of the USAID Projects has been the research and development of cowpeas, sorghum and millet. Cowpeas is presently replacing peanuts and it is an excellent fodder crop. It was pointed out that a major mistake of the projects was that the research did not get involved in animals which are very important in the farming system of Niger.

3) There is no mechanism in place in the country to document the adoption of varieties or technologies. Like in many countries, farmers are reluctant to indicate what they have done in their farms.

4) Linkage between research and extension is very weak.

5) The general impression was that developed technologies had not gone beyond the research stations and there was no impact of research on agricultural production and productivity.

6) Scientists did not have serious problems with the completion of the technical data forms sent by the coordinators.

Documents on agricultural research and extension and agricultural statistics were made available to the team. Also, the ICRISAT economist was given a set of economic data forms for collection of relevant information for the impact assessment study.

Visit to Ghana

Places visited by the assessment team included the Council for Scientific and Industrial Research (CSIR) Secretariat, the Extension Services Department, Crop Services Department, Sasakawa Global 2000 Project and the Nyankpala Agricultural Experiment Station (NAES).

I) Council for Scientific and Industrial Research

At the CSIR Secretariat, the team was informed that the agricultural research system in Ghana was reviewed in 1989. Based on the review a base line data is now available at the Secretariat and this is being concretized. Also restructuring of agricultural research is currently going on to make it more effective. A position has been created at the CSIR for a Deputy Director General for Agriculture to take care of Agricultural Research and to serve as the link between the CSIR and the Ministry of Agriculture. A National Agricultural Research Committee, NARC, (an apex body for agricultural research) has

been created to formulate policy, regulate research efforts and to control research funds. The technical secretariat of NARC is based in CSIR. The NARC is under the Agricultural Policy Coordinating Committee (APCC) and it is linked to the research institutes by the Management Boards.

About 0.05 of Agricultural Gross Domestic Product goes into research. Regional extension-research linkage committees to be chaired by the Regional Secretaries for Agriculture are to be set up under the restructuring exercise.

Relevant documents on the restructuring and review reports were made available to the impact assessment team.

II) Extension Services Department

The Director of Extension Services pointed out that even though they were aware that SAFGRAD has been active in Ghana, it was difficult to pull out exactly its contribution to maize, cowpeas and sorghum development and production. He indicated that a number of socio-economic surveys have been conducted in Ghana. The results have shown that the package of improved technology developed through the collaborative efforts of researchers and extentionists have been widely adopted by farmers. The result is an improvement in the incomes of farmers. He cited as an example of the impact of improved technology on the economy of Ghana, Mampong-Sekyedumasi area where there has been tremendous improvement in the living conditions of farmers as revealed by the improvement in their housing, the standard of living, the increase in the number of bicyles used by farmers etc. He also mentioned the exportation of maize by Ghana in 1989 and 1990 as a result of the availability of improved technology. On research-extension linkage, he indicated that strong links exist as revealed by the presence of representatives of Crop Services Department (DCS) and Extension Services Department (DAES) on the management boards and the sub-committees of the research institutions. Annual planning sessions are organized for maize

and cowpea during which extensionists, researchers and farmers review the previous year's results and plan together the activities for the year. Some feedback on the appropriateness of technologies being promoted by the researchers and extensionists are obtained during such planning sessions. Also annual maize and legumes workshops are jointly sponsored by the Crop Services, Extension Services Departments and the crops Research Institute. The workshops serve as the forum for researchers, extensionists, policy makers and farmers to review research findings, the grower recommendations and to discuss burning issues related, to agricultural research, development and production. Research-extension linkage committees are also being established in the country. There is a training and communication unit staffed by personnel of Crops Research Institute, Extension Services Department, and Crop Services Department. The training and communication unit is responsible for facilitating the disemination of information on maize and cowpeas as well as organizing in-service training (for extensionists) and staff of DCS. This is being achieved through the preparation of production guides for extensionists and farmers hand books. The DAES has a unit for testing of the quality of maize and cowpea varieties prior to release. Through the interaction of extensionists, farmers and researchers, the desired qualities of varieties are identified.

The Director indicated that there was a need for more research effort in Sorghum and Millet. The MOA is currently trying to promote the production of sorghum in the arid areas in the southern Ghana where they might perform better than maize.

III) Crops Services Department

At the Crop Services Department, the Director, Dr. ofori indicated that his department serves as the link between applied and adaptive research. The department has the mandate to conduct adaptive research in conjunction with the Crops Research

Institute and the extension services department. In addition, the department coordinates the breeder seed production activities of CRI, the foundation seed production by the Grains Board and the activities of certified seed growers.

Dr. Ofori pointed out that the seed inspection unit which was until recently under the DCS, has been made an autonomous body and designated as the Plant Protection and Regulatory Services. The seed inspection unit guarantees quality. The government is expected to promulgate the National Seed Law very soon.

On seed storage, Dr. Ofori said that processing and storage facilities have been established at Ho Winneba, Kumasi and Tamale. He also indicated that the extension and crop services staff involved in seed production have been offered management training.

IV) Sasakawa Global 2000

The Acting Director of the SG 2000 Project informed the team that Ghana was selected for the Project because they realized that appropriate technology had been developed by the Crops Research Institute and the problem was how to transfer the technology. The Project was initially quite successful as farmers could obtain yields of 16-20 bags (50 kg) per acre using the improved technology compared to about 4-5 bags per acre obtainable from the traditional technology. The response from the credit institutions was also quite good and this made credit more accessible to farmers. The result was that there was surplus maize production while storage facilities were not available and the market was not ready to absorb the surplus. Consequently, farmers could not sell their produce or had to sell at prices lower than the minimum guaranteed price. The result was that farmers defaulted in the loan repayments.

Based on this experience, the Project has reviewed its activities and is currently actively involved in the storage of maize, sorghum, sesame and cowpeas and in the reorganization of the seed industry.

The Acting Director indicated that good maize, cowpea and soybean varieties are available in the country. However, there is a "vacuum" so far as sorghum is concerned.

V) Nyankpala Agricultural Experiment Station

The Manager of NAES, Mr. Mercer-Quarshie briefed the team on the purpose of the station, the different programmes, the personnel at post and on training and the achievements of the project.

Mr. Quarshie indicated that some few years ago maize was of little importance in Northern Ghana. In 1970, the Northern region was fourth in total National Maize Production. In 1989 the northern region was the first in maize production in Ghana. Cowpea production has also increased in the region. The present practice is for farmers to use the recommended improved cowpea varieties in sole crop and in rotations. Because of the earliness of the varieties released, farmers now grow two crops a year in succession. He indicated that the progress was not so good with sorghum and millet. He attributed this to the rapid turnover of staff. However, some sorghum varieties have been released and some progress is being made.

On the transfer of network leadership to NARS, the team was informed that NARS was ready to take up this role. However, they cautioned that in order to ensure sustainability of networks there is a need for assured funding and trust by donors before the transfer of leadership to the NARS can be made. The feeling was that in Ghana, the capacity to coordinate the networks was there. It is however necessary to get assured funding particularly from regional organizations such as ECOWAS.

On the relevance of the available technology, the team was informed that the available technologies are relevant. However, there is a need for good government policies to ensure the adoption of improved technology. For example, subsidies on inputs have been removed in Ghana resulting in the doubling of the price of fertilizer. It was indicated that adoption may not be as high as expected because of government policies with respect to credit.

On seed, the team was informed that there is a problem with distribution and marketing. Maize seed seemed to have been taken care of but there is problem with seed of other crops.

The team was informed that strong links exist between research and extension and the outfit of the Deputy Director General of Research has been charged with the responsibility for closing the gap between research and extension.

During visits to some farmers fields, the team was informed of the farmers preference for the high yielding improved maize varieties. They mentioned Okomasa, Aburotia, Kawanzie and SAFITA-2 as varieties very popular in Northern Ghana.

From the visits to the four countries, it was evident that the Networks (particularly the Maize and Cowpea Networks) have had positive impact on agricultural research as well as production and productivity of maize and cowpea in the countries visited with the exception of probably Niger.

6.2. Impact assessment review meeting

The SAFGRAD impact assessment review meeting was held from 19-20 November in Ouagadougou. During the meeting, preliminary reports on the assessment were presented by the three consultants, Dr. Taye Bezuneh, Dr. Allan Schroeder and Dr. Scott. In his presentation, Dr. Taye indicated that the assessment revealed that research process at regional level had established

mechanisms for identifying constraints, research priorities and networking strategies. Also, the SAFGRAD Network model involving the NARS, OAU and the IARCs had been effective in the enhancement of national research capacity. As a result of the major role played by the NARS in networking, the relationship between the IARCs and the NARS had been strengthened in addition to the mutually beneficial interactions among the NARS themselves.

Dr. Schroeder indicated that the percentage of germplasm nominated by the NARS in the regional trials improved tremendously during SAFGRAD II. There was an increase in the percentage recovery rate of regional trials sent out to NARS during Phase II, indicating an improvement in efficiency. Furthermore, success in the efforts to transfer improved technology to farmers had increased tremendously during SAFGRAD II as well as the number of varieties released.

In his presentation, Dr. Scott made the following conclusions: (i) Improved technologies for maize, cowpea and sorghum were reaching the producers at various rates of adoption. (ii) The relative net performance of the main commodities compared to their competitors, varied substantially from country to country. (iii) Agricultural GDP had grown moderately for all of the countries in the sub-sample, indicating that a significant portion of that growth was due to advances in production and productivity. (iv) The process of dissemination and adoption of improved maize technologies was often faced with obstacles that retarded the impact on production, productivity and incomes. The most important factor that exerted a negative impact on adoption were the price and availability of inputs, profitable disposal of produce, availability and price of credit and the agro-industrial transformation of agricultural commodities. Therefore, future agricultural research endeavours should dedicate more resources and efforts towards strengthening the crucial link between the development and adaptation of technology at the level of the research station and its adoption at the level of the producer.

Finally, the SAFGRAD Network Coordinators made presentations on the technologies in the pipeline at the end of Phase II.

The Maize Network Coordinator presented a list of maize technologies in the pipeline (Tables 6 and 7). He informed the meeting that the Network was actively working on the following:

- Breeding for *Striga* tolerant varieties.
- Breeding for early, drought tolerant varieties.
- Promoting the adoption of technologies made available by the Network.

He reported that materials with moderate resistance to *Striga hermonthica* had been identified and an effective screening method developed by IITA. Ghana and Cameroon national programmes were working on the development of new *Striga* tolerant varieties. In addition, work was in progress to develop cultural practices for *Striga* control as well as biological control of *Striga*.

The Network Coordinator indicated that work in the above areas would be consolidated, provided financial support to SAFGRAD was assured. He emphasized the fact that SAFGRAD had continued to be the only organization that had focused research on the development of maize technology for Sudan and Sudano-Sahelian zones. The Network had been actively developing varieties that combined early maturity (90-95 days) with drought tolerance and reasonably good yields since 1984. Some of the varieties had been made available to national programs. However, there was the need to incorporate higher levels of tolerance and adaptation to drought stress in the released varieties so as to make them more attractive to farmers.

In order to promote the adoption of technologies made available by the Network, the following activities were proposed for the Maize Network:

Table 6. Promising Network technologies in the pipeline

1. Extra-early varieties

(Across 8131 x JFS) x Local Raytiri
CSP
CSP-SR
CSP x Local Raytiri
Pool 27 x Gua 314
Pool 28 x Gua 314
Pool 30 x Gua 314
TZEE-W1
TZEE-W2
TZEE-Y
TZEE-Yellow Pool
TZEE-Y-SR
TZEF-Y

2. Early varieties

Across 90 Pool 16 DT
Farako-Bâ 90 Pool 16 DT
Ina 90 Pool 16 DT
Kamboinse 90 Pool 16 DT
Maroua 90 Pool 16 DT
Nyankpala 90 Pool 16 DT
Maka SR.

3. Improved agronomic practices

a. Tied ridges for soil moisture conservation in Sudan Savanna.

b. Better seed treatment chemicals for improved plant establishment and grain yield.

c. Increased plant population for higher grain yield of early and extra-early varieties.

d. Earlier date of fertilizer application (top dressing) for increased yield of early and extra-early varieties.

Table 7. Promising maize varieties in the pipeline for release in West and Central Africa countries.

Country/Name of variety	Origin
BENIN	
DMR-ESRW	IITA
Pool 16 DR	SAFGRAD
EV 8328-SR	CIMMYT-IITA
BURKINA FASO	
FBC 6	INERA (Burkina)
KPB	
KPJ	
KEB	
KEJ	
Pool 16 DR	
TZEE-W-SR	
CAPE VERDE	
Maka	Mauritania/SAFGRAD
CENT. AFR. REPUBLIC	
CMS 8501	Cameroon
CMS 8710	Cameroon
CHAD	
Pool 16 DR	SAFGRAD
CMS 8602	Cameroon
CSP X L. Raytiri F3	SAFGRAD
COTE D'IVOIRE	
Maka	Mauritania/SAFGRAD
Pool 16 DR	SAFGRAD
TZEF-Y	SAFGRAD
Ferke 8336	CIMMYT
GHANA	
Dorke SR (Pool 16-SR)	Ghana
Obatanpa	Ghana
TZEE-W-SR	SAFGRAD
GUINEA	
Ikenne 83 TZSR-Y-1	IITA
EV 8428-SR	CIMMYT-IITA
IRAT 200	IRAT/CI
IRAT 292	IRAT/CI
Poza Rica 8526	CIMMYT

Table 7. (Cont'd)

Country/Name of variety	Origin
MALI	
DMR-ESRY	IITA/SAFGRAD
TZEF-Y	SAFGRAD
Los Banos 8531	CIMMYT
Across 8464	CIMMYT
TZEE-Y-SR	SAFGRAD
MAURITANIA	
Gwebi 8422	CIMMYT
Pool 16 DR	SAFGRAD
CsP Early	CIMMYT/SAFGRAD
NIGER	
Composite Kollo 1	Niger
NIGERIA	
White Composite	IAR & T
TZEF-Y	SAFGRAD
TZEE-W-SR	SAFGRAD
SENEGAL	
Sids 8445	CIMMYT
Ikenne(1) 8149-SR	CIMMYT-IITA
TOGO	
AB 11	Togo
AB 12	Togo
AB 13	Togo
TZEF-Y	SAFGRAD
TZEE-W-SR	SAFGRAD

- Research for improved cultural practices for early and extra-early varieties;
- Influencing of government agricultural policies.

Before the review meeting came to a close, the officials of the USAID/Washington, confirmed that the SAFGRAD Phase II would terminate on 31st December, 1992. However, USAID was still interested in supporting networks in Africa. It was indicated that USAID was willing to consider a joint proposal for funds for network support from the IARCs and OAU. Furthermore, USAID was prepared to consider a request for an extension of SAFGRAD II at no extra cost in order to allow enough time for the preparation and submission of project proposals by the different networks.

6.3. Results of the Impact Assessment Study

In December 1992, USAID decided to extend the SAFGRAD project up to March 31, 1993, to enable the impact assessment study to be completed. Following the three-months extension, USAID appointed Dr. John Sanders, a professor of economics at the Purdue University as a replacement for Dr. Scott on the assessment team. The final results of the impact assessment study presented by the reconstituted team is summarized below:

Institutional Evolution of the NARS

Analysis of the institutional base of the NARS revealed that there had been a significant agricultural research capacity building during the last two decades. During the period 1981-91, the number of researchers tripled in Burkina Faso, Ethiopia and Ghana. In Niger and Kenya the number of researchers almost doubled. In addition, there had been sustained improvement in the quality of research staff in the countries studied. The SAFGRAD contribution had been largely the enhancement of professional

development and the improvement of research skills through long and short-term training, monitoring tours, biennial workshops, seminars, conferences, technician training, steering committee meetings and publications.

There had been 2-3 fold increase in the number of NARS researchers with doubling or tripling of the number of technicians and substantial increase in non-technical personnel, during the last decade. A high percentage of the national research budgets were used to pay salaries with very little left for operations.

The report concluded that the triangular concept of network coordination, involving parternership of OAU, IARCs and the NARS with financial support from USAID had been very effective in improving the research capacity of NARS and the development of scientific leadership and confidence.

Development and Flow of Technology

The results of the technical analysis of the SAFGRAD commodity networks revealed that the Maize Network had been successful in stimulating the capacity to solve maize production problems. Several technologies had been developed and/or identified by NARS Lead Centers and IITA core scientists. Furthermore, there had been spill-over of the technologies to member-countries. The report indicated that of the three networks assessed, the Maize Network had the highest number of technology releases for the 5 countries surveyed (Ghana, Nigeria, Cameroon, Burkina Faso, and Mali). Also, the Maize Network had been an important vehicle for moving technologies developed at diverse sources to NARS. For example, about half of the maize varieties released in the five countries studied had been in SAFGRAD regional trials. The NARS of the Maize Network developed the greatest number of technologies that had been released (18) with nine varieties each from Ghana and Cameroon. The report also

showed that the NARS of the Maize Network were seriously engaged in technology generation, and in some countries there was much more work in development than in adaptation. For example, Cameroon, Ghana and Nigeria were the most active in the generation of new maize technologies, with about ten times more technology generation than adaptation. The report further indicated that maize entries contributed by NARS to the SAFGRAD regional trials from 1982 to 1991 had declined while the percentage contributed by the international centers had increased substantially to 75% by 1991. This was attributed to the fact that maize is not an indigenous crop to Africa. Hence the NARS would not be a continuous source of new genetic diversity. Consequently, diversity had been provided from sources such as CIMMYT in Mexico, where maize is indigenous.

Generally, there had been marked increases in the level of activities undertaken and completed by NARS scientists. Both the number and types of experiments carried out on-station and on-farm had been more than doubled. It was concluded that the activities of the Maize Network had definitely influenced this change.

Economic Impact

The impact study revealed that maize production in Ghana had approximately quadrupled within a decade (1982-1991). The area under improved varieties increased from 20% to 50%. The internal rate of return to the public investment in the national maize program was reported to be 74%. It was also reported that social benefits from the adoption of the SAFGRAD associated early maize varieties (SAFITA-2, Kawanzie and Dorke-SR) ranged from $400,000 to $ 1.4 million per year. Boughton and de Frahan (1993) in a study of the introduction of new maize cultivars in the high-rainfall Guinea savanna zone of Mali reported a rate of return of 135%.

On future prospects, the report indicated that the chances for achieving people-level impact from investments in agricultural technology development and transfer in sub-saharan Africa had improved over the last decade. Also, the amount of technology available to influence productivity gains had increased. From the technologies currently in the pipeline, it was evident that future prospects were good for achieving further significant gains in productivity. At the same time, progress had been made in the policy environment thus influencing the operation of input and output markets. Nevertheless, these prospects are dependent on the availability of funds to ensure the sustainability of the gains that have been made and to the need for attention to the maintenance of the natural resource base.

6.4. Some Comments on the SAFGRAD Impact Assessment Report

During SAFGRAD I, two types of Regional Uniform Variety Trials (RUVT) were offered to national programs in the semi-arid zone of sub-Saharan Africa. These were the RUVT-1 and RUVT-2 involving the late/intermediate and early maturing varieties, respectively. The national programs from the sub-region contributed varieties for these trials in addition to the nominations from IITA and CIMMYT. It must be pointed out that during SAFGRAD I, the major breeding emphasis of the national maize programs in the sub-region was on the development of late and intermediate maize varieties. The SAFGRAD I evaluation team recommended that the SAFGRAD Maize improvement program should emphasize on the early and extra-early varieties. At that time, no breeding program was being carried out in the extra-early maturity group by either the NARS or the IARCs while there was very little emphasis on breeding of early varieties (90-days to maturity) for the guinea savanna zone of West and Central Africa. It was therefore not surprising that the contribution of varieties to the regional trials by the NARS which were engaged in varietal development in the sub-region such as Nigeria, Ghana,

Cameroon, Senegal and Côte d'Ivoire was very high during SAFGRAD I. No regional trials were offered in the extra-early maturity group because there were only a few extra-early local varieties available at that time.

By 1984, the potential for extra-early varieties to fill the hunger gap in July in the semi-arid zone in West and Central Africa, particularly in the sudan Savanna zone, had been well established by IITA/SAFGRAD maize scientists. A program for the development of extra-early varieties was therefore initiated by IITA/SAFGRAD. Extra-early germplasm collected from Columbia, CIMMYT, India, Burkina Faso and improved early streak resistant germplasm from IITA were used to develop several extra-early varieties for the sub-region. In addition, breeding populations were developed for the extra-early maturity group and have been undergoing continuous improvement through the use of different recurrent selection schemes to ensure continuous release of varieties of this maturity group. New and promising extra-early germplasm collections are periodically introgressed into the breeding populations to ensure that there is adequate genetic variability to ensure continuous progress from selection. Thus new extra-early varieties are and will be continuously extracted from the available breeding populations.

In 1990, following an arrangement with the IITA Maize Program to harmonize germplasm delivery to NARS in order to prevent duplication and over-burdering of the national scientists, the coordination of the late/intermediate variety trials was left with IITA. On the other hand, the organization of the international testing of all early and extra-early maturing varieties in the sub-region was made the responsibility of SAFGRAD. Since IITA took over the late/intermediate trial in 1990 the contribution of the NARS to this trial in terms of varieties in 1990 and 1991 was not taken into consideration in the impact assessment study which focused mainly on the SAFGRAD activities. Since it is in this maturity group that the NARS have traditionally made the major contribution in terms of varietal

development, the new arrangement with IITA was partly responsible for the reduction of the NARS contribution to the SAFGRAD regional trials during SAFGRAD II. Furthermore, since no NARS or IARCs ever worked on the extra-early varieties, nomination of varieties of this maturity group for the regional trials were made exclusively by SAFGRAD; NARS could not nominate any entries for RUVT-extra-early. Thus since 1990, the NARS have nominated only early varieties for the regional trials.

The increasing importance of the extra-early and early varieties in the semi-arid zone (especially in the sudan Savanna) for filling the hunger gap has aroused interest of NARS in maize of the two maturity groups. Also, extra-early germplasm with desirable attributes are now available from the resident research program of the Maize Network Coordinator.

It is anticipated that NARS assigned responsibility for generating varieties of different maturity groups for the Maize Network would be encouraged to take over the breeding work on the extra-early varieties from the Maize Network Coordinator in future. It must be emphasized that the extra-early maturing varieties constitute a new generation of technology initiated since 1987. The extra-early germplasm and varieties have just been made available to the NARS. It would, therefore, require at least another five years for participating NARS to contribute elite varieties to the network regional trials.

In conclusion, it should be stressed that the fact that the contribution of NARS vis-à-vis SAFGRAD to the regional trials declined during SAFGRAD II has nothing to do with the fact that maize is not indigenous to Africa "so that there would be no wide local genetic base to work from". It should be noted that even though maize is not indigenous to Africa, there is a wide collection of maize germplasm from all over the world under storage in CIMMYT, IITA, USDA and in several national programs in West and Central Africa. These germplasm banks are at the disposal of national programs and exotic germplasm can be

requested for use in the national breeding programs at any time to broaden the genetic base of breeding populations, pools etc. Therefore, the problem is not with lack of availability of genetic diversity.

SECTION B

COWPEA NETWORK

1.O. Collaborating National Programs and National Coordinators

Because of the disparities in the strength of national agricultural research systems (NARS) the Cowpea Steering Committee assigned research responsibilities to six relatively strong programs known as Lead Centers. This was based mainly on the comparative advantage that these countries possess, namely, availability of reasonable research infrastructure and skilled manpower; the research interest of each national program and the willingness to share research results with other member countries. Adaptative research activities remain the responsibility of each member country. The Lead Centers, Associate Centers, Technology adopting centers and national cowpea Coordinators in 1992/93 were as follows:

1.1. Lead Centers

The six Lead Centers and their assigned responsibilities were as follows:

1) **Burkina Faso**

- Research activities: Breeding for drought, *Striga*, insect and disease resistance.
- National Coordinator:
  Dr. (Mme) Dabire Clémentine
  Entomologist, INERA,
  01 B.P. 476
  Ouagadougou, 01.

2) **Cameroon**

- Research activities: Entomology with particular emphasis on storage insect pests control.

- National Coordinator: Mr. Chevalier Endondo, Agronomist, IRA, B.P. 33, Maroua.

3) **Ghana**

- Research activities: Breeding for coastal, sub-humid transition and northern Guinea savanna zones; cowpea entomology including storage; and agronomy. Validation studies for *Striga* resistance in the Sudan savanna zone.

- National Coordinator: Dr. K.O. Marfo Breeder, Crop Research Institute Nyankpala Agric. Expt. Station Nyankpala, Ghana.

4) **Niger**

- Research activities: Breeding for drought, *Striga* and disease (*Macrophomina* spp.) resistance and agronomy.

- National Coordinator: Mr. Hassan Hamma Breeder, INRAN, B.P. 240, Maradi.

5) **Nigeria**

- Research activities: Breeding for drought, *Striga*, insect and disease resistance; and agronomy and cowpea pathology and entomology.

- National Coordinator: Dr. O.O. Olufajo, agronomist, Department of Agronomy, IAR/ABU, PMB 1044, Zaria.

6) **Senegal**

- Research activities: Breeding for drought, insect and disease resistance.

- National Coordinator: Mr. Samba Thiaw, agronomist, ISRA/CNRA, B.P. 53, Bambey.

1.2. Associate Research Centers

The Associate Research Centers are national programs other than Lead Centers found to possess reasonably sufficient skilled manpower and average research infrastructure. They conduct research of their own interest. In addition, they play an important role in the multilocation testing of new technologies developed by RENACO Lead Centers and/or IITA-GLIP.

The Associate Research Centers were appointed in 1989 by the Steering Committee and include:

1. **Benin**
   - Research activities: Breeding and adaptation for coastal, sub-humid, transition and Guinea savanna zones with particular emphasis on resistance to insects, diseases and *Striga*.
   - National Coordinator: Mr. A.O. Sanni, agronomist, SRCV-Niaouli, BP. 3, Attogon.

2. **Mali**
   - Research activities: Breeding and adaptation for northern Guinea and Sudan savanna and the Sahel with particular emphasis on resistance to insects, diseases and *Striga*.
   - National Coordinator: Mr. Aliou Traore. Breeder, IER/DRA/SRCVO, BP 438, Bamako.

1.3. Technology Adopting Centers:

1. **Cape Verde** - Mr. C.E.P. Silva, agronomist INIA/MDRP, BP 50, Praia.

2. **Central African Rep.** - Mr. Abel Yandia, SOCADA, B.P. 997, Bangui.

3. **Chad** - Mr. Alkhali Saleh, Directeur National du Projet Gassi, B.P. 441, N'Djamena.

4. **Côte d'Ivoire** - Mr. Adou Amalaman, agronomist Institut des Savannes, BP 635, Bouake 01.

5. **The Gambia** - Mr. M. Kemoring Trawally Dept. of Agric. Research, Yundum Research Station P.O. Box 739, Yundum

6. **Guinea Bissau** - Mr. Domingos Fonseca, agronomist MDRA/DEPA/CENEMAC, C.P. 71, Contuboel, Bissau.

7. **Guinea Conakry** - Mr. F.L. Guilavogui, entomologist, Institut de Recherches Agronomiques de Guinée (IRAG), BP 1003, Conakry.

8. Mauritania	- Mr. Sidi R'Chid, agronomist, CNRADA, BP 22, Kaedi.
9. Sierra Leone	- Mr. Trawally National Agric. Research Coordination Council (NARCC)
10. Togo	- Mrs. Akossiwa Duyiboe, agronomist, DRA, BP 2318, Lome.

2.0. Management of the Cowpea Network

The 11th meeting of the Steering Committee of RENACO was held at Ouagadougou from May 19-21, 1992.

(a) **In attendance**

- **Members of the Steering Committee**

Dr. O.O. Olufajo (Nigeria) --Chairman
Mr. H. Hassane (Niger) --French Secretary
Dr. K.O. Marfo (Ghana) --English Secretary.
Dr. (Mrs) C. Dabire (Burkina Faso)
Dr. N. Muleba (Network Coordinator)

- **Observers and resource persons.**

Dr. D. Florini	- Cowpea pathologist, IITA, Ibadan, Nigeria.
Mr. E.F. Deganus	- IITA, ICP, Ibadan, Nigeria.
Dr. T. Bezuneh	- SAFGRAD Director of Research.
Dr. J.M. Menyonga	- SAFGRAD International Coordinator
Prof. A.M. Emechebe	- SAFGRAD Oversight Committee Member; Cowpea Pathologist, IAR, Samaru, Nigeria.
Dr. A. Schroeder	- USAID/W, SAFGRAD Impact Assement Team member.

(b) **Agenda of the meeting**

1) **General matters**

- Formal adoption of the proceedings of the 10th Steering Committee meeting;
- Matters arising from the minutes;
- Impact assessment studies on RENACO.

2) **RENACO activities**

- Progress report by RENACO Lead Centers;
- Report of the 1991 cowpea regional trials;
- Research workplans for 1992 crop season to be executed by RENACO Lead Centers; and
- RENACO Regional Trials planned for 1992 crop season;

3) **Miscellaneous matters**

- Support to national programs in 1992;
- Proceedings of the Joint-Maize-Cowpea-Sorghum Seminar for research agronomists held at IITA, Ibadan, Nigeria, in January, 1991;
- Proceedings of RENACO Workshop held at Niamey, Niger, March, 1991;
- Seed production actvities by the Network;
- The next Steering Committee meeting.

(c) **Highlights of the deliberations**

The following were noted by the Steering Committee:

- A format for the impact assessment study developed by a Consultant, Dr. A. Schroeder, from USAID/W, was thoroughly examined and discussed. The Committee noted with satisfaction that most of the objective indicators listed for the Level 1, i.e, strengthening

of and evidence of strengthening national programs and new technologies developed by the Lead centers, were fully carried out by the network. The relevant information on such activities was available with the Network Coordinator. As to increased national adaptive research activities, new technology transfer; and increased production, productivitity and farmers incomes; progress indicators listed for levels 2, 3 and 4 of the evaluation study; the Steering Committee observed that a lot of the information required could be obtained from the SAFGRAD Coordination Office or from the selected sample countries for the assessment study. The Network Coordinator was however, advised to contact individual national programs, if some specific information was needed.

. Although progress reports were not received from two RENACO Lead Centers, namely, Cameroon and Niger, the Steering Committee noted with satisfaction that Lead Centers were conducting collaborative research activities in different cowpea improvement disciplines. These included, breeding, agronomy, entomology and pathology as well as *Striga* resistance studies. New technologies developed by Lead Centers were regionally tested. Some of them, IT81D-994, KVx291-47-222 and KVx402-19-5, for *Striga* resistance; KVx402-5-2, KVx396-4-5-2D, KB85-18, CR-06-07, for different adaptation studies; gave the best performance across locations in different countries.

. Research workplans, regional trials and support to national programs for the 1992 crop season were discussed.

(d) Recommendations

The Cowpea Steering Committee adopted the following recommendations.

1) In view of the recent outbreak of cowpea diseases in the northern Guinea savanna and the devastating effect of *Striga*, it is recommended that if funds are available, a meeting of the working groups of breeders, pathologists, entomologists and *Striga* specialists be convened latest by March 1993 to devise ways of tackling the problems and to plan collaborative research.

2) Considering the fact that the scientists working on cowpea *Striga* are presently using different methodologies, the Committee recommends that IITA should assist the network by organizing a training workshop on pot culture and related methodologies for scientists working on *Striga* in the sub-region, such training may take place at the Institute for Agricultural Research, Samaru as well as IITA.

3) The Committee noted with satisfaction the encouraging report on the final evaluation of SAFGRAD-II and the achievements of the networks so far. It is recommended that all efforts should be made to ensure continued funding of the networks in order to consolidate the gains of the past years and maintain the tempo of activities. SAFGRAD should intensify its role in sensitizing policy makers in member countries through the organization of African Unity on the importance of research in attaining sustained food self-sufficiency.

4) It is recommended that some of the weaknesses that were pointed out in the evaluation report, especially the non-inclusion of socio-economic studies should be tackled as soon as possible.

3.0. Strengthening National Programs

Efforts made to strengthen national programs involved the following activities.

3.1. Collaborative Research

Collaborative research activities were carried out by the 6 RENACO Lead Centers and 2 Associate Centers according to research responsibilities assigned to them by the Steering Committee. With the exception of Benin, Mali, Niger and Senegal, progress reports for the 1992 crop season were received from Lead Centres reported as below:

Burkina Faso

a) Breeding

. Selection: F_2 plants, descendants of 44 crosses made during the previous year were subjected to evaluation in a *Striga* sick plot, under no insecticide application treatment at Kamboinse. Promising 77 lines were selected. They will be yield tested during the 1993 crop season. F_4 plants, descendance of 32 crosses made in 1990/91 of which 64 families were selected for best performance with and without insect pest protection were evaluated without insect pest protection in 1992. Disease-free 63 plants that produced and matured pods were selected. Their F_5 plants will undergo adaptation trials in the three semi-arid agro-ecologies in Burkina Faso in 1993: the Sahel at Pobe, Sudan savanna at Kamboinse and northern Guinea savanna, at Farako-Bâ.

Adaptation trials: Sixty-one lines, from the IITA cowpea improvement program at the ICRISAT Sahelian Center, were subjected to adaptation trial at two locations: Kaboinse in Sudan savanna and Pobe in the Sahel; two sowing dates were used at each location. Only best performing lines across sowing dates and

locations, of which 65 were selected. They will go for preliminary yield tests with or without insecticide treatment in 1993.

Preliminary yield tests: A total of 78 promising new cultivars were yield tested in four trials at four locations in the three semi-arid agro-ecological zones in Burkina Faso, with or without insect pest protection. Based on the best performance across locations and taking into consideration , diseases and *Striga* resistances, whenever their attacks were noticed, high yield and good quality grain. The following entries were selected:

For preliminary yield test-1: KVx404-25, KVx414-22-19, KVx404-19-85, KVx421-19 and KVx404-19-65 under no insect pest protection; and KVx421-19, KVx404-25, KVx430-6, KVx426-10, KVx404-19-15 and KVx 414-22-19 protected against insects pests.

Preliminary test yield trial-2: KVx403P-50T, KVx403P-41T and KVx403P-20T treated with or without insecticide.

Preliminary yield trial-3: ***Striga* resistance:** *Striga* resistant cultivars across locations were Waongo-1, KVx420-7, KVx420-8, KVx420-4, KVx426-4 and Waongo-2.

Preliminary yield trial 4: best dual purpose cowpea cultivars: producing high yields of both grain and fodder were: IAR7/180-4-5-1, KVx426-10 and KVx426-2.

. Regional and International trials: These consisted of two *Striga* resistance trials: one from RENACO and the other from IITA-Ibadan; and adatation trial from IITA. The RENACO *Striga* resistant trial was conducted at two locations. It tested 12 cultivars. The best resitant cultivars were: KVx 164-65-5, KVx402-19-5, KVx397-6-6, IT81D-994, IT82D-849 and B301. The IITA *Striga* resistance trial was conducted at Kamboinse only. It tested 16 cultivars. *Striga* resistant cultivars were IT89KD-245, IT89KD-107, IT88D-867-11, IT90K-59, IT90K-77, Waongo-1, B301, Suvita-2, IT82D-849 and Waongo-2. The adaptation trial was

conducted at Kamboinse. It tested 16 cultivars of which the best performing were: KVx396-4-5-2D, the local check; IT89KD-107, IT88DM-363 and IT87D-885.

. **Advanced yield trial:** 20 promising cultivars were tested at five locations in three different semi-arid agro-ecological zones in Burkina Faso. At each location, cultivars were subjected to pure-stand and association cropping systems; each with or without insect pest protection. The best beforming cultivars across locations and treatments were: the check KVx396-4-5-2D, KVx404-8-1, KVx414-22-2, KVx414-22-9, KVx421-25, KVx428-9, KVx414-22-72, IT85D-3516-2 and KVx421-2J.

b) Entomology

Entomological research in 1992 consisted of: insecticide evaluation, including mixtures of Deltamethrine and Systhoate; study of the effect of plant population on insect pest attack on cowpea; and evaluation of advanced lines with and without insecticide application in pure-stand as well as association cropping. The neem tree seed extracts controlled thrips insect pest only at the rate of 1000g and 1500g per 12l of water. At these rates, they did not differ significantly from Deltamethrine and Reldan insecticides. They also appeared to control pod-sucking bugs as good as the two insecticides although they did not induce any seed yield significantly different as compared to the untreated check; whereas the two insecticides significantly increased seed yield. Insecticides, Deltamethrine and Systhoate did not differ significantly from one another in controlling aphids and thrips. Both insecticides had no effect as compared to the untreated check in controlling pod sucking bugs. Deci alone, however, induced good flowering, but did not differ from its mixture with Systhoate for pod formation and seed yield.

With regards to the effect of plant population on insect pest infestation: aphids population was very low at all test locations; cultivar KVx165-14-1 were more infested than the local check; and the highest plant population (0.20 x 0.80m) was the most infested. Pod sucking bug incidence was the least at Pobe; plant population density appeared not to be a problem with it, whereas cultivar effect was significant; the local check was the least infested. Pod sucking bugs significantly reduced yield at Kamboinse and their effect was even more serious in farmers' fields than in the experimental stations at this location. In general, seed yield was significantly higher at the two low population densities (100 x 1.5m) and (1.00 x 2.25m) than the high density (0.20 x 0.80m); however the former two densities did not differ significantly from one another.

Under no insect pests protection treatments, cultivars: KVx404-22-2, KVx414-22-2, KVx414-22-9, KVx414-22-19, KVx430-4 and KVx414-22-72 exhibited the least flower thrips incidence. Whereas cultivars: KVx414-22-72, KVx414-22-21, KVx414-22-19 and the local check exhibited the least number of pod damage by pod-sucking bugs. Seed yield under no insect pests protection varied from 285 to 696 kg/ha; the least yielding cultivars being: the local check, IAR7/180-4-5-1 and KVx404-62-2J. Whereas under insect pest protection seed yield varied from 1074 to 1604 kg/ha.

Cameroon

a) Breeding

A breeding program for improved storage characteristics has been initiated in Cameroon since 1991. The objectives of the program is to develop new cultivars with seed and pod resistances to bruchids, a storage weevil insect pest; large, white seed-type; persistance of leaves after pod maturity and harvest; good agronomic characteristics; and resistance to the prevailing diseases. In 1992, a progeny of 27 crosses were grown at two locations at Mukebi and Guering in northern Cameroon. F_2 plants

were observed to segregate for aphid borne cowpea mosaic viru; some crosses exhibited high probability of recovering segregating lines combining ideotype with tough, unbreakable and indeliscent pods.

b) Storage

No new research activities in cowpea storage structures were conducted 1992. However, an extension of "solar heating" and three clear plastic bags" to sterilize cowpea seeds from bruchids, and to prevent the insects from destroying stored cowpea was undertaken. In this regard, extension workshops were conducted in 14 villages. They involved cowpea scientists and extension workers. Each extension worker was provided with CRSP technical bulletins Nos. 2 and 3 for the solar heating and triple plastic bag devices. They were also given instructions on how to conduct the village tests using the solar heating and the three plastic bag techniques and gathering farmers reactions.

c) Other activities

Cowpea improvement: These activities consisted of the evaluation of introduced gerplasm, collections and crosses made locally. New cultivars were identified for:

1) high seed yield: IT90K-277-2, IT86D-538, TVu 347 and TVx 1948-01F;

2) high fodder yield: IT87D-453-2 and IT89KD-245-1;

3) good resistance to virus: IT90K-284-2 and IT89KD-245-1;

4) good resistance to *Striga*: IT82D-849, B301, KVx291-47-222, KVx402-19-5; and

5) high yield under minimum insecticide application: IT85F-2687, IT85F-2684, IT85D-3517 and IT82E-16

Agronomic research: these consisted mostly of association cropping systems involving cowpea and sorghum.

Ghana

a) Breeding

Breeding nurseries: 49 lines derived from F_7 and F_5 BC_2 families of some local cultivars crossed with heat tolerant germplasm were tested in replicated trials. A total of 13 lines which outperformed the local check in both grain yield and desirable agronomic traits were selected. They will be yield tested in multilocation trials in 1993. F_3 lines from BC_3 (a back cross) involving Vallenga (IT82E-16) crossed with Bengpla (IT83S-818) and Brown eye (IT81D-1137), were grown in 1992. White seeded lines were selected and are being increased for yield trials in 1993. A program to convert all released cultivars to *Striga* resistance initiated in 1990 is well advanced. Some of the selections will be evaluated for *Striga* resistance in a *Striga* sick plot at Manga in 1993.

Yield trials: Three sets of cowpea cultivars consisting of early maturing, *Striga* resistant and savanna adapted entries introduced from IITA, Ibadan were tested at Nyankpala. Unfortunately a good test for *Striga* resistance could not be obtained as *Striga* germination was very poor with no vigour.

Multilocation trials: Promising cultivars identified in the previous years yield trials were grouped in three trials: early, intermediate and late maturing entries; and tested at four locations. It should be noted in the late maturing cultivars, that the mean yield across location was 1338 kg/ha; the local cultivars, Sumbrisogla, gave the highest grain yield, 1552 kg/ha. Also in a national cowpea coordinated trial, none of the released cultivars performed well. Adverse weather conditions suppressed grain yield of an average of 700 kg/ha.

b) Other activities:

Entomological research, especially for cowpea storage in the hupmid zones were not reported.

Niger

The 1992 cowpea annual progress report and that of 1991 have not been received at the time of this write-up.

Nigeria

a) Breeding

The cowpea breeding research activities in Nigeria in 1992 concentrated on cultivar testing. In this regard, preliminary yield trials, advanced yield trials, adaptation trials involving cultivars introduced from RENACO and IITA, multilocation testing, *Striga* resistance trials, dual purpose cowpea trials (seed and fodder yield production), vegetable cowpea trials, and all Nigeria coordinated trials were conducted. It is worth noting that: cultivars IAR2/180-4-9 produced high yields of both seed and forage; other dual purpose cultivars of interest were: IAR/48/15/1, IAR7/180-4-5, IAR2/180-4-12 and IAR/72. Cultivars IS86-275N and KVx396-4-5-2D out-yielded other entries in the adaptation trial for Sahelian-Sudanian zones. Besides two *Striga* resistant checks: IT82D-849 and B301, cultivar KVx402-19-5 was virtually free from *Striga* attack.

b) Agronomy

Agronomic research consisted of studying the response of cultivars to nitrogen (N), phosphorus (P), magnesium (Mg) and zinc (Zn) rates; and NPK compound fertilizers as well as weed control. N and Zn rates had no significant effect on cowpea seed yield. Whereas increasing rates of P augmented cowpea seed yield up to 30 kg P_2O_5/ha; rate at which a plateau was reached maximum.

Similarly, increasing levels of NPK compound fertilizer:20:10:10 and 15:15:15 increased seed yield significantly. But the former reached a maximum at 300 kg NPK/ha, whereas the latter reached a plateau at the same rate; high N content in the compound fertilizer appeared, thus, not, advantageous to cowpea crop production. Increasing dose of Mg also increased cowpea yield up to 10 kg Mg/ha; at this rate, cowpea yield was 19% greater than that of Mg unfertilized plot. With regards to weed control, herbicides Metolachlor plus Imazethapyr and Metolachlor plus Imazquin resulted in the highest cowpea seed yield and marginal revenues comparatively higher than farmers' traditional cultural practice.

c) <u>Parasitic weed control</u>

c.i) *Alectra vogelii* control

- **Reaction of cowpea cultivars to *Alectra* infestation:** A total of 18 cultivars were tested for their reaction to *Alectra* infestation. The results were as follows:

  1) Cultivars: B301, IT90K-39, IT90K-76 did not accept any *Alectra* emergence.

  2) Cultivars: IT81D-994, IT81D-985, IT89KD-245-1, IT89KD-245, IT86D-534 and TN121-80 received some *Alectra* shoots, but did not differ anyway from *Alectra* resistant cultivars;

  3) Cultivars: IT82D-849 and Suvita-2, both *Striga* resistant, were susceptilble to *Alectra* infestation; they tolerated a greater amount of *Alectra* emergence.

- **Effect of N and P fertilizers on *Alectra* infestation:** increased rates of P, including 45 and 90 kg P_2O_5 increased cowpea yield as well as number of cowpea plants infested with *Alectra* and the number of the

latter. N rates had no effect on *Alectra* count, but the 60 kg N/ha significantly reduced cowpea yield as compare to 30 kg N/ha.

c.ii) Control of *Striga gesnerioides*

Seventeen cultivars were screened for *Striga* resistance at three locations in Northern Nigeria: Samaru, Talato-Mafara and Sokoto. From the study, the most *Striga* resistant cultivars were at:

1) Samaru: IT90K-59, IT90K-76, TN93-80, IT82D-849, TN121-80 and B301;

2) Sokoto: IT90K-52, IT90K-76, B301 and IT82D-849. However, the results indicated that soil was not uniformly infested with *Striga* at this location: pockets of heavy infestation or virulent strains were observed.

d) Cowpea pathology

About 190 different cultivars and lines from Nigeria, IITA and RENACO were screened in the field for resistance to scab (*Elsinoe phaseoli*) and *Septoria* leaf spot (*Septoria vignae* and *S. vignicola*) disease resistance. Several entries were found to be resistant to either scab or *Septoria* leaf spot. But only the following two cultivars combined resistance to both diseases: IAR4/48/51-1 and IT82D-849.

A chemical control study of three diseases: scab, *septoria* leaf spot and brown blotch (*Colletotrichum capsisi*), was also conducted. The result indicated that plots sprayed with fungicides: Benlate, Roval TS and Delsene, at 7 days interval had lower disease incidence than those sprayed at 14 days interval. In addition, plants grown from seeds treated with the same fungicides and subsequently sprayed weekly, starting at 4 or 5 weeks after sowing had the lowest incidence of the three

diseases; these plots also had higher yield than those of other regimes. The seeds from control plots were of poor quality.

e) Entomology

A total of 140 cultivars and lines mainly from Nigeria and IITA were screened in the field for insect pests (i.e., aphids, flower thrips and *Maruca*) resistances. A certain number of entries appeared to be very promising; they included, K-28, IT90-59,IT90K-76, IT89KD-389 and IT90K-261-3. A new insecticide, Dynanec (abamectin), which is specifically for controlling leaf miners and mites was studied against two standard insecticides: Sherpa Plus and Cymbush F.P. The results indicated that Dynanec was ineffective against cowpea insect pests; cowpea plants sprayed with this insecticide did not perform anyway better than those without the treatment.

Senegal

The 1992 annual progress report was not received as of August 31, 1993.

Benin

The 1992 annual progress report was not received as of August 31, 1993.

Mali

The 1992 annual progress report was not received as of August 31, 1993.

3.2. Regional trials

Because 1992 was a year during which no workshop was held, no new RENACO regional trials were distributed to National Agricultural Research Systems (NARS). Instead, they were encouraged to repeat the same regional trials conducted in 1991 to better appraise the materials introduced. Otherwise, to conduct adaptive research with promising materials in different recommendation domaines for eventual release to farmers. However, new fresh seeds for the regional *Striga* resistance trial were dispatched to all countries that had conducted the trial in 1991. This was meant to ensure the purity of the entries being tested. In addition fresh seeds of regional trials were dispatched to NARS which requested for it on their own in 1992.

A total of 32 sets of the trials were distributed to NARS in May-June, 1992. They are summarized as below:

Trial Name	**No. of sets sent out**
1) Adaptation to Northern Guinea savanna	3
2) Adaptation to Sahelian-Sudanian zones	1
3) Adaptation to transition zones	4
4) *Striga* resistance	20
5) Bruchid insect pest resistance	4
6) Aphid insect pest resistance	1
Total	32

Feedback for 25 sets or 78% were received as of July 31, 1993.

The results of the *Striga* resistance showed the susceptible check, IT82E-32, to be the earliest and most densely *Striga* infested cultivar at most of the test locations. Of the three *Striga* resistant cultivars, only IT82D-849 and B301 exhibited the

least *Striga* infestation at most locations; whereas TN5-78, was resistant to some locations and exhibited a certain level of susceptibility at some other locations. Three test cultivars: IT81D-994, KVx402-19-5 and KVx402-19-1, exhibited similar reactions as IT82D-849 and B301 at all locations. This indicated that they are likely to be *Striga* resistant too. Yield wise, IT81D-994 was among the least yielding cultivars; it, therefore, contrasted with the two other cultivars, KVx402-19-1 and KVx402-19-5, which were among the highest yielders. The latter two cultivars appeared, thus, not only useful in controlling *Striga* damages, but also ensured high productivity.

From the *Striga* resistance trial results, all cultivars purported to be *Striga* resistant were confirmed in Benin, Burkina Faso, Ghana and Mali at Cinzana. These locations can be classified as *Group 1*. Whereas the remaining locations where *Striga* resistance of most cultivars were not confirmed, were classified as *Group 2*. It is likely that *Striga* strains in *Group 2* locations could have been more agressive than those of *Group 1* locations. It should be noted, however, that even in *Group 1* locations, there was a low level of *Striga* infestation in most resistant cultivars. This may be due to the presence, at a low frequency, of virulent strains (genotypes) in a population of predominantly less virulent strains. Because none of the resistant cultivars was immune to *Striga* infestation at all locations, it could be assumed that continuous cultivation of a resistant cultivar, especially, if its *Striga* resistance was controlled by a single dominant gene, one could be imposing a selection pressure that might result to building up a virulent strain capable of causing even more serious damage to cowpea crop in the future. It is therefore, adviseable to capitalize on more than one source of *Striga* resistance to control *Striga* damages in the sub-region.

The results of other regional trials were reported as a supplement of the 1991 regional trial results.

3.3. Funds Allocated to National Programs

The cowpea network provided financial assistance to national programs in 1992 upon request and subject to satisfactory justification of funds previously received as presented in Table 1.

Table 1. Funds allocated to national programs for the 1992 crop season

Country	Cheque No.	Date	Amount		Observation
			US $.	CFA F.	
Benin	1362	2/9/92	1,000	240.000	
Burkina Faso	J1035578	16/11/92	2,000	538.295	
Cameroon	1379	28/9/92	1,000	258,300	281.126 to be justified
Cape Verde			-	-	
Cent. Afr. Rep.			-	-	
Côte d'Ivoire	4835670	16/6/92	600	159.500	
Gambia			-	-	
Ghana	1339	22/6/92	1,000	265.300	228.108 to be justified
Guinea Bissau			-	-	
Guinea Conakry			-	-	
Mali			-	-	
Mauritania			-	-	
Niger			-	-	
Nigeria			-	-	
Senegal	1372	23/9/92	1,000	256.300	
Sierra Leone			-	-	
Tchad			-	-	
Togo			-	-	
Total			6,600	1.718.495	509.234

3.4. Miscellaneous

Research methodologies and technologies developed by IITA-SAFGRAD cowpea research team prior to 1987 and those developed by NARS scientists through the network effort and extended to member-countries since 1987 are given in Table 2, 3 & 4. Technologies adopted by NARS for further on-farm testing or released to farmers are shown on Tables 5 & 6, respectively. New cultivars developed by NARS through the network and IITA which are to be regionally tested in 1993 are listed in Table 7.

Table 2. Research methodologies and findings extended by RENACO and accepted by NARS.

Description of research methodology and findings	Country applying it
- Use of sowing dates in screening cowpea for adaptation to semi-arid zones.	Burkina Faso, Niger and Nigeria
- Use of a single seed descendant method for advancement of lines from F1 to F6 in less than 3 years and for the development of new varieties in less than 7 years.	Burkina Faso
- Minimum insecticide to protect cowpea against insect pests	Burkina Faso, Cameroon, The Gambia, Ghana, Guinea Conakry, Niger, Nigeria, Senegal.
- Maize-cowpea relay cropping and cereals-cowpea intercropping systems	Benin, Burkina Faso, Cameroon, The Gambia, Ghana, Guinea Bissau, Guinea Conakry, Nigeria, Tchad, Togo
- Bio-test for screening cowpea for bruchids resistance	Burkina Faso, Cameroon, Ghana, Guinea Conakry, Mali, Togo.
- Bio-test for screening cowpea for aphids resistance	Burkina Faso, Ghana.
- Tied ridges technique	Burkina Faso, Cameroon, Mali.
- *Striga* resistance methodology	Benin, Burkina Faso, Ghana, Mali, Niger, Nigeria, Senegal, Togo.

Table 3. *Striga* Resistant Cowpea Varieties in West and Central Africa

Name of variety	Origin	Country having identified or confirmed the resistance to *Striga*	Country in which the resistace to *Striga* hold	National programs incorporating the reistance in good agronomic background
- B301	Botswana	Burkina Faso (IITA-SAFGRAD)	Burkina Faso, Mali Senegal, Niger, Nigeria, Benin	Burkina Faso, Mali, Niger, Nigeria
- IN93-80	Niger	Niger (INRAN)	Burkina Faso, Mali, Senegal, Niger, Nigeria	Burkina Faso
- TN121-80	Niger	Niger (INRAN)	Burkina Faso, Mali, Senegal, Niger, Nigeria	Burkina Faso
- KVx61-1	Burkina Faso	Burkina Faso (IITA-SAFGRAD)	Burkina Faso, Mali	Burkina Faso
- KVx61-74	Burkina Faso	Burkina Faso (IITA-SAFGRAD)	Burkina Faso, Mali	Burkina Faso
- IT81D-994	IITA-Ibadan	Burkina Faso (INERA)	Burkina Faso, Nigeria	Burkina Faso
- KVx100-21-7	IITA-Ibadan	Benin	Benin	-
- KVx295-124-52	Burkina Faso	Burkina Faso (INERA)	Benin, Burkina Faso	Burkina Faso
- KVx291-47-222	Burkina Faso	Burkina Faso (INERA)	Benin, Burkina Faso, Mali	Burkina Faso

Table 4. New cultivars with good attributes identified by NARS beginning 1987 upto date.

Type of attribute	Cultivars	Country in which it was identified or developed
Drought resistance	- Gorom Local, KVx30-305-3G, KVx396-4	Burkina Faso (IITA-SAFGRAD)
	- KVx402-5-2, KVx402-19-5	Burkina Faso (INERA)
	- B89-504N, IS86-275N	Senegal (ISRA)
	- IB85-18	Niger (INRAN)
Cultivars adpated to drought and excess moisture conditions	- KVx396-18-10, KVx396-4-5-2D, KVx402-5-2	Burkina Faso (INERA)
Multiple disease resistant cultivars	- IT86D-1056, IT83D-213, IT85D-3517-2, IT85D-3516-2, IT85D-3577 and IT83D-219	Nigeria (IAR)
Aphids resistant cultivars	- IT82E-25, IT83S-742-2, IT86D-3577	IITA, Ibadan (Nigeria)
	- IVx295-2-124-51	Burkina Faso (INERA)
Dual purpose cowpea varieties: (fodder and seed yield)	- IAR7/180-5-1, IAR/180-4-5	Nigeria (IAR)

Table 5. Cultivars adopted by NARS since 1987 and which are in the various stage of multilocation trials and on-farm testing and demonstration before their eventual release.

Country	Name of Variety
Benin	IT84S-2246; IT84D-513; TVx 1999-01F; IT81D-1137; KVx 100-21-7; KVx295-124-52.
Burkina Faso	KVx 30-309-6G, KVx 61-1, KVx 396-4-4; KVx 396-4-5; KVx 396-18-10; KVx402-5-2; KVx402-19-5; KVx295-2-124-51.
Cameroon	IT81D-994
Cape Verde	IT83D-444;
Côte d'Ivoire	GR-06-07; TVx3236; IT87D-1010; IT87D-1627; IT88DM-363; IT84S-2246; IT88DM-361; IT82E-32.
The Gambia	IT84S-2049; IT83S-728-13; TVx3236.
Ghana	IT81D-1137; IT83S-818; KVx396-4-2; KVx396-4-4; KVx396-4-5; KVx396-18; KVx30-305-3G.
Guinea B.	IT85D-3516-2; IT86D-498; IT87S-1390; IT85D-3577; IS86-275N; IS87-416N; IT86D-373; KVx30-309-6G.
Guinea C.	IT84S-2246-4; IT82E-32; IT86D-1048; IT86D-1056; IT85F-867-5.
Mali	TN93-80; TN121-80; KVx30-309-6G; KVx61-1; Dan Illa; TVx3236.
Mauritania	IT86D-472; IT82D-544-4; IT81D-897; IT82ED-716; IT82D-927; TVx 1948-01F; TVx3236; KB85-18; KVx295-2-124-89; TVx295-2-124-51; IT81D-994.
Niger	A18-1-1; A73-1-2; KVx30-309-6G; KVx100-2; KVx30-305-3G; KVx396-4-5.
Nigeria	TVx 3236; IT81D-994.
Togo	TVx 1850-01E; IT81D-985; 58-146; IT83S-818; IT82E-66; KVx 396-4-4.

Table 6. Cultivars released or in use by farmers since 1987

Country	Variety
- Benin	IT82E-32; IT81D-1137; TVx 1850-01F.
- Burkina Faso	TVx 3236, Suvita-2; KVx396-4-4; KVx396-4-2; KVx396-4-5-2D.
- Cape Verde	KN-1; Local Santiago
- Ghana	Vallenga (IT82E-16); Asontem (IT82E-32).
- Guinea Bissau	IT82E-9; IT83S-889.
- Guinea Conakry	IT85F-867-5; IT83D-338-1; IT84S-2246-4.
- Mali	Suvita-2, KVx61-1.
- Mauritania	IT83S-343-5-5; Suvita-2; KVx 256-K17-11
- Nigeria	Sampea-7 (IAR-48)
- Senegal	IS86-275
- Togo	58-146

Table 7. New promising cultivars developed by NARS through the nework effort and IITA to be tested in regional trials in 1993.

Cultivar	Origin	Characteristics
1. KVx426-1	INERA, Burkina Faso	*Striga* resistant and adapted to Sudan-Sahelian zones & northern Guinea savanna.
2. KVx426-4	- do -	- do -
3. KVx404-22-3	- do -	Better adapted to Sahelian-Sudanian zones & northern Guinea savanna
4. KVx404-52	- do -	- do -
5. KVx414-16T	- do -	- do -
6. KVx414-22-21	- do -	- do -
7. KVx397-6-6	- do -	- do -
8. IT90K-76	IITA, Ibadan	Better adapted to Sudan & Guinea savannas
9. IT89KD-374	- do -	- do -
10. IT89KD-245	- do -	*Striga* resistant, better adapted to Sudan & Guinea savannas
11. IT90K-59	- do -	- do -
12. IT90K-77	- do -	- do -
13. NI86-650-3	Benin	*Striga* resistant
14. Waongo-1	Niger/IITA/BF	- do -
15. VYA	Cameroon	Better adapted to Sudan & Guinea savanna
16. Ploplilon	Guinea Bissau	Resistant to diseases of Guinea savanna.

4.0. Evaluation of the Impact of the Network

4.1. The Impact Assessment Study Findings:

In 1992, the cowpea network, as well as other SAFGRAD crop commodity networks were subjected to an impact assessment study. The study found that the network had been successful in stimulating the initiative and the capacity of national cowpea scientists in solving cowpea production constraints in their home countries. This was supported by the following:

- There has been an increase in germplasm developed by national programs and nominated for regional trials from SAFGRAD I to SAFGRAD II;

- The number of breeding crosses made, progenies promoted to yield trials, and experimental trials and other treatments have increased measurably at national program level from SAFGRAD I to SAFGRAD II in the countries sampled;

- The names of new cultivars and countries in which they were released were identified. Some of the names appeared for more than one country indicating that network facilitated spill-over had occurred.

In addition, the study found that: except for Cameroon, cowpea production in the sampled countries: Burkina Faso, Ghana, Mali, Niger and Nigeria, had increased subtantially from 1987 to 1991. The increase was due to (i) both expansion in area and productivity for Burkina Faso, Ghana and Nigeria; (ii) expansion in area and slight increase in productivity for Mali; and (iii) expansion in area and a decline in productivity for Niger. However, for Ghana and Nigeria, a detailed study showed that the area grown to improved cultivars had expanded at the

expense of local varieties; but, in contrast the productivity of improved cultivars declined while that of local varieties increased.

Cameroon was the only country for which the area grown to cowpea declined while the production increased slightly for the period 1987 through 1991. The increased production was, therefore, attributed to increased productivity.

As a weakness, it was pointed out that there was no strong linkage between agricultural research and extension services and farmers with the network. This deficiency could have affected detrimentally the transfer of technologies to farmers.

4.2. Implication of the Impact Study Findings

Three issues, listed below, raised by the impact assessment study do not necessarily imply weakness of the cowpea network in the discharge of its mandate. They, however, reflect the necessary evolutionary steps the network went through from its inception till date. This is particularly true because NARS had to be brought out from a state of productivity in which they were not too long ago and making them active partners in agricultural development.

4.2.1. *Decline in productivity of improved cultivars*

The countries, i.e., Ghana (in the northern parts), Mali, Niger and Nigeria for which cowpea expansion area, particularly for improved cultivars was, evident; are severely infested with *Striga*. Therefore, as rightly observed, productivity declines are expected if the released cultivars are susceptible to *Striga*. This is because *Striga* infestation causes severe to toal yield losses, especially when *Striga* is combined with drought or with any other weather hazards. Improved cultivars, i.e., IT82E-16, IT82E-32, KN-1, TN88-63, TVx 3236 and SAMPEA-7 with the exception

of SUVITA-2 and TN5-78 which were released in those countries until 1989 were *Striga* susceptible.

With a new range of improved and *Striga* resistant cultivars, such as: KVx61-1, KVx61-74, KVx30-303-3G, KVx30-309-6G, KVx295-124-52, KVx402-19-1, KVx402-19-5, TN93-80, TN121-80 and many others which are being adopted by farmers in those countries, productivity decline with expansion area of improved cultivars is expected to be remedied in the near future.

4.2.2. Lack of expansion area in Cameroon

Until 1989, Cameroon did not have a well structured cowpea breeding and agronomic research programs. Its major activities were concentrated on cowpea storage research. The local cultivar: VYA, in northern Cameroon was the only best performing cultivar. None of the introduced cultivars could outyield it. But as of 1989, line KVx396-4-5-2D, promoted by the network, started out-performing VYA. The line has been promoted by national scientists in Cameroon for on-farm testing in 1992. It is expected that it will soon be released and cowpea production in Cameroon would certainly retain farmers interest.

4.2.3. Weak linkage between the network and technology transfer

Prior to 1987-89, several factors were responsible for weak linkage between NARS and Extension Services and farmers. Some of them were: poor understanding of technology experimentation and transfer process by NARS scientists and/or insufficient technologies to be transferred or did not meet farmers liking even if they were available.

With the increasing number of appropriate technologies, i.e., drought, disease and *Striga* resistant; insect pest tolerant and good quality grain cultivars; the need for their extension to farmers would be given top priority. This calls for a strong linkage between NARS and extension services and farmers. For

instance, in Burkina Faso, national cowpea scientists found themselves compelled to establish a linkage with extension services in 1989 as they had developed sufficient number of appropriate technologies. To this effect, they organize a yearly workshop to expose to extension workers, new technologies to be transferred to farmers. Steps are being taken by the World Bank, through its structural adjustment programs, to establish formal linkage between agricultural research and extension services in Burkina Faso, Ghana, Mali, Niger and many other countries. As many more new and appropriate technologies are being developed, linkage between research and extension services gets stronger.

SECTION C

Major problems encountered

Both the maize and cowpea networks were successful in stimulating the initiative and capacity of national scientists to identify and alleviate production constraints of the two crops. New and appropriate technologies were either identified or developed by Network Lead Centers and IITA maize and cowpea international scientists. They were made available to member-countries for national adaptive research;some technologies met farmers needs and requirement. They were, therefore, released. In farmers hands, the new technologies contributed immensely to increased production, productivity and farmers' income. These achievements led to the 1992/93 USAID-SAFGRAD evaluation team's conclusion that: both maize and cowpea networks have had a measurable impact on agricultural food production in member-countries.

In spite of these achievements several factors still limit maize and cowpea production in the semi-arid zone. These include the following:

1) <u>Maize</u>

- **Resistance to termites:** Termites are an important constraint to maize production in the Semi-Arid Tropics (SAT). A reliable method for screening maize for resistance to termites needs to be developed. Screening of maize genotypes for resistance to termites should also receive increased attention.

- **Management practices:** There is the need to refine the management practices for growing the new maize varieties made available by the Network to NARS, especially the extra-early varieties.

- **Drought tolerance:** Even though a number of drought tolerant varieties have been released by the Network, drought still remains the major abiotic factor for the yield instability of maize in the SAT. There is the need to upgrade the level of drought tolerance in the released varieties.

- ***Striga* tolerance:** *Striga* hermonthica is a major biotic constraint to maize production in the SAT. Screening methodology for breeding for *Striga* resistance/tolerance has been developed and sources of resistance/tolerance have been identified by IITA. Efforts at incorporating the resistance into maize germplasm by some members of the Network should be supported financially.

2) **Cowpea**

- Insect pests are a major cowpea production constraint. A sound cowpea production at this point in time cannot be envisaged without the use of pesticides, which the African economy and farmers income levels cannot afford.

- *Striga gesnerioides* causes severe damages to cowpea in the Sahel and the Sudan and Coastal savanna zones. It is expanding to the Guinea savannas and even in the humid zones, particularly in shallow soils where continuous cultivation has been introduced.

- Scab, brown blotch, web blight and *Septoria* leaf spots are causing severe yield losses under humid conditions.

In order to remove these constraints, a vigorous maize and cowpea improvement research programs coordinated by the networks are absolutely necessary. Unfortunately the uncertainity of the continuation of both networks and insufficient funds in 1992 made it extremely difficult to carry out networks' activities

smoothly. For instance, the Steering Committee of both networks' met only once in May 1992 to plan activities for 1992 crop season; no meeting was held at the end of the 1992 crop season to discuss research findings, identify new promising technologies and to discuss on production constraints deserving attention in 1993. Also formal visits to NARS member-countries, either by the network coordinators or NARS resource scientists as well as the biennial maize and cowpea monitoring tours were not organized during the season. These activities are very essential for backstopping and the stimulation of the morale of NARS scientists to solve production constraints of mutual interests in the sub-region. Because these did not take place, the networks did not receive progress reports on collaborative research on time from some NARS member-countries. Hence, their research activities and findings could not be reported as required by the networks.

During the transition period: April 1 to September 30, 1993, the design, mandate, scope of work, number of member-countries, funding level and the mechanism for each network would be reviewed.

Follow-up Activities for 1993

While fate of both networks is being decided by USAID, the follow-up activities for the transition period are as follows:

Maize network

* Collaborative research activities for maize improvement conducted by NARS Lead Centers;

* Resident research activities carried out by the network coordinator in collaboration with the National Maize Program of Burkina Faso;

* Promotion of adaptive research activities in all member countries;

* Seed multiplication and varietal maintenance;

* Regional trials;

* On-farm level community seed production in Burkina Faso; and

* Publication of research results.

Cowpea Network

* Collaborative research activities for cowpea improvement conducted by NARS and Lead Centers;

* Adaptive research activities, including on-farm testing and demonstration conducted by all member-countries;

* Seed multiplication and germplasm maintenance carried out by the network Coordinator in collaboration with National Cowpea Program of Burkina Faso;

* Regional trials;

* Report of various research activities: Results of the 1992 regional trials, progress of network collaborative research activities, etc.

1993-09

Maize and Cowpea Collaborative Research Networks for West and Central Africa, ANNUAL REPORT 1992/93

AU-SAFGRAD

AU-SAFGRAD