THE SAFGRAD COLLABORATIVE RESEARCH NETWORKS: AVENUES FOR STRENGTHENING NATIONAL AGRICULTURAL RESEARCH SYSTEMS IN SUB-SAHARAN AFRICA.

D R A F T

SAFGRAD Phase II Report

1987–1991

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I. BACKGROUND

The food production situation in sub-Saharan Africa has continued to be a major concern of both OAU Member States and the international community, in search of a coherent strategy towards reversing the downward trend in the economic development of Africa.

The prediction that the human population in sub-Saharan Africa will reach one billion by the early part of the 21st century and the concomitant need for increased food and agricultural production, coupled with the already heavy dependence of this population on agriculture, the progressive decline in per capita food and agricultural output, the problems of soil erosion losses as well as the decline in land quality and productive capacity, all point to the urgent necessity to develop technology towards a more productive and sustainable agriculture. Thus, in this type of harsh environment, with substantial variation in stress factors, region-specific research is necessary. No country alone can be expected to cope with the enormity of the problem, since the effective development of National Agricultural Research Systems (NARS) has been commonly identified as the principal constraint to agricultural development in sub-Saharan Africa.

In response to the agricultural production crisis experienced in semi-arid Africa in the mid-1970's, and in recognition of the urgent need for a concerted regional effort, African Heads of State and Government created SAFGRAD in 1977, following the resolution (Resolution 505 XXIX) adopted by the 1976 OAU Council of Ministers in St. Louis, Mauritius.

1.1. Objectives

The overall objective of SAFGRAD has been to improve the quality and quantity of the major food grains (sorghum, maize, millet, and cowpea), as well as to improve the resource base for productive agriculture in the semi-arid regions of sub-Saharan Africa. SAFGRAD's specific objectives are to:

- i) *coordinate agricultural research activities among Member States in order to avoid unnecessary duplication of efforts and to mobilize resources to foster dynamic, inter-African research cooperation at regional and sub-regional levels;*

- ii) *promote and facilitate the dissemination and exchange of improved germplasm and technical information through regional trials, workshops, symposia and monitoring tours;*

- iii) *strengthen national agricultural research systems through short-and long-term training with special attention being given to enhancing indigenous research capabilities of Member States;*

- iv) *promote the dissemination and transfer of technologies adapted to the small farmer and thus strengthen institutional links between research and extension agencies at the national level; and*

- v) *enhance resource management research through its farming systems project activities.*

1.2. SAFGRAD Membership.

SAFGRAD initially started out with 18 member countries. This number soon increased to 26, consisting of the following OAU Member States in West, Central, East and Southern Africa: Benin, Botswana, Burkina Faso, Cameroon, Cape Verde, Central African Republic, Chad, Côte d'Ivoire, Ethiopia, Gambia, Ghana, Guinea,

Guinea Bissau, Kenya, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone, Somalia, Sudan, Tanzania, Togo, Uganda, and Zambia

1.3. SAFGRAD Strategy.

Central to SAFGRAD II activities has been the development of food grain research networks, and other networks, in collaboration with International Agricultural Research Centres (IITA, ICRISAT, ICRAF, etc.). ~~The OAU/STRC~~-SAFGRAD's major strategy for serving national agricultural research systems and food grain farmers in sub-Saharan Africa has been through the management and development of the following networks:

i) The West and Central Africa Maize Research Network (WECAMAN),
ii) The West and Central Africa Sorghum Research Network (WECASORN),
iii) The West and Central Africa Cowpea Research Network (RENACO),
iv) The West African Farming Systems Research Network, (WAFSRN),
v) The Eastern Africa Regional Sorghum and Millet (EARSAM) Network, and
vi) The Agroforestry Network for Semi-Arid Lowlands of West Africa (SALWA).

The SAFGRAD network model involved the mobilization of NARS resources and partnership of the International Agricultural Research Centres (IARCs), and faculties of agriculture of some African universities. SAFGRAD also promoted and coordinated research into the development of more efficient water conservation technologies in order to support sustained crop production.

1.4. SAFGRAD Mandated Crops

In the West and Central African semi-arid region, food grains constitute about 70% of the staple food. In Eastern Africa, maize and sorghum cultivation predominates; millets constitute 10-15% of the production. FAO statistics (1) indicate *that sorghum and millet production in West and Central Africa covers approximately 8.5 and 10 million hectares, respectively (Annexes 1 and 2). In Eastern Africa, 4 million tons of sorghum grain is produced annually on about 6 million hectares. Finger millet is the dominant millet type grown in Eastern Africa, particularly in the dry areas that are usually unsuitable for sorghum production. There is also limited production of pearl millet in this region. The total area devoted to the production of millets approximates 2 million hectares, with a total annual grain yield of just over a million tons (Annex 3).*

Maize is the most important crop in Eastern and Southern Africa, where it constitutes the major staple food crop. There has been an increase in maize production in West and Central Africa during the last two decades: this has been accomplished mainly by the expansion of production areas rather than by improvement of average yield due to the use of better technology and management (2). West and Central Africa account for only 15% of total production of maize on the continent. In this region, over 50% of the maize is produced in the northern Guinea savanna. However, maize cultivation has gradually moved into the Sudan savanna which at present produces about 20% of the total output.

Cowpea is extensively grown in West and Central Africa. About two thirds of the world production is derived from this sub-region. Nigeria and Niger are the major producing countries. The average yield of cowpea in the region is less than 0.33 t/ha and this contrasts with a potential yield of 0.5-2.5 t/ha. As a common ingredient of the diet of the majority of the population in the region, cowpea provides about 50% of the daily quality protein requirements.

1.5. The SAFGRAD Environment

The region is characterized by low and irregular rainfall. Soil fertility is generally low, especially in terms of phosphorus and nitrogen levels. A deteriorating crop land base could hardly support the increasing human population pressure. The problems of soil erosion losses as well as the decline in soil quality and productive capacity, all point to the urgent necessity to develop technologies towards supporting a more productive and sustainable agriculture.

Referring specifically to the Semi-Arid Tropics (SAT) of West and Central Africa (Fig. 1), the region can be delineated into three major ecological sub-divisions comprising the Sahel, Sudan savanna and the northern Guinea savanna. Typically, the Sahel zone has limited surface water resources. Rainfall is monomodal in pattern, low in amount and poor in distribution. The total precipitation varies from under 300 mm/year in the northern most parts to about 600 mm/year in the south. Relatively low temperatures (10-15°C) characterise the period from November to February, whilst April and May record average day temperatures of 40°C and over. The length of the growing season varies from 2 to 4 months (June to October), with the dry season lasting from October/November to May/June. The Sahel is an important grain-producing area, with millet and cowpea as the better adapted crops. Out of the over 12 million hectares of millet cultivated in the SAT, over 65% is derived from the Sahel zone.

By comparison, the Sudan savanna has a relatively higher rainfall of between 600-850 mm/year. The pattern of the rainfall, although more reliable than the Sahel zone, is occasionally irregular for the effective sustainance of crop production. This zone accounts for almost 17% of the land area in West and Central Africa. The length of the growing season extends from 3 to 5 months. Rains start in late May or early June. Drought stress is frequent, mainly due to the erratic rainfall pattern rather than its acute shortage. Temperatures range from 15 to 40°C. Sorghum is the major cereal; but millet is equally important, particularly in the transitional Sudano-Sahelian zone. Maize occupies more than 20% of the cultivated area and its production is on the increase. Cowpea and groundnuts are largely intercropped within the above mentioned cereals.

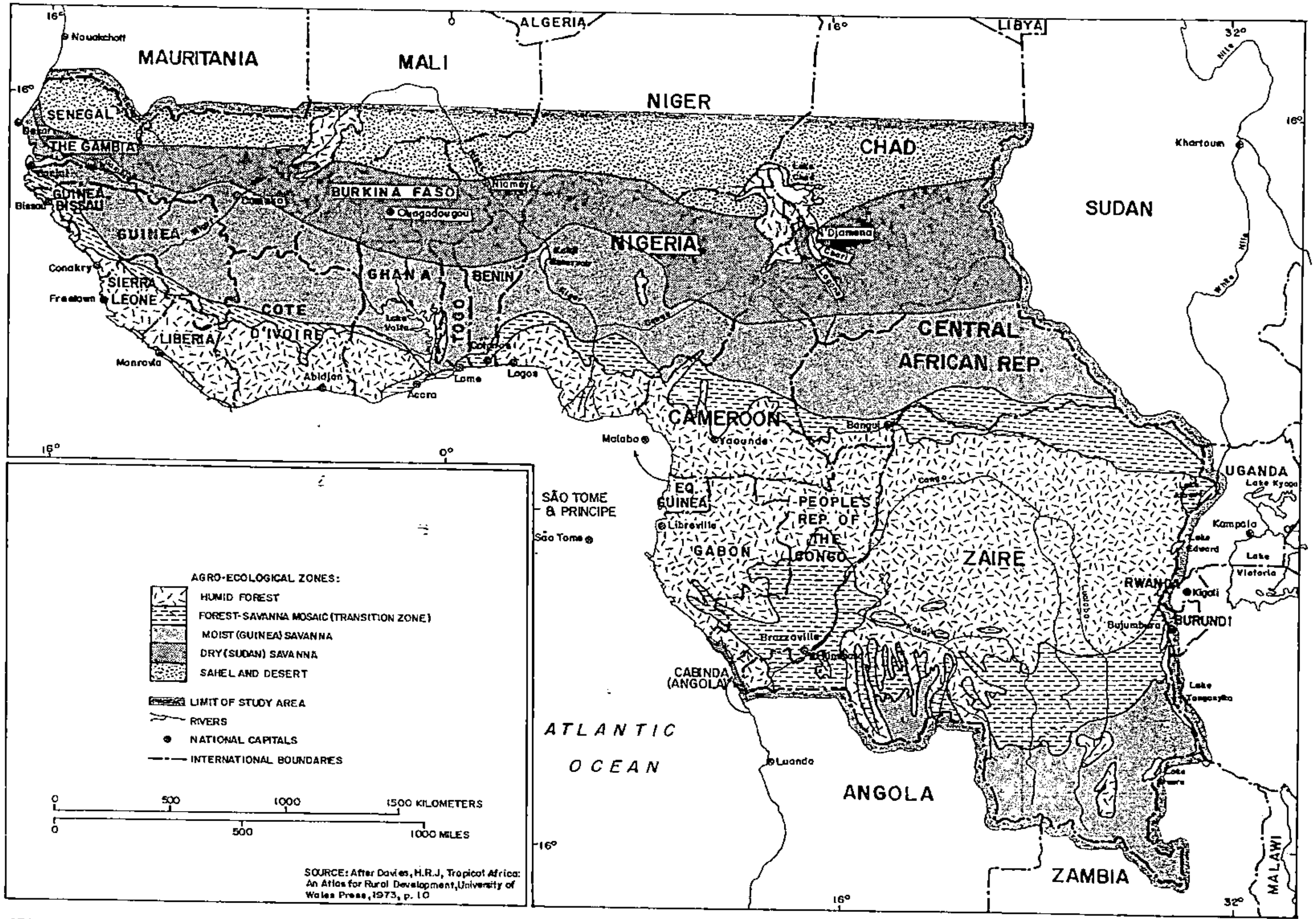


Fig. 1. Agro-ecological zones of West and Central Africa.

By and large, the northern Guinea savanna has relatively more dependable rainfall of 850-1100 mm/year, spread over a 4-to 6-month period. Soils are largely alfisols and types similar to those of the Sudanian zone. Maize is the predominant cereal, with sorghum cultivated largely in the transitional Sudano-Guinean zone where the rainfall range is between 700-900 mm. Cowpeas and groundnuts are the important pulses, usually intercropped within cereals.

Eastern Africa is characterized by the highland zone (over 1800 m above sea level), the intermediate zone (1500-1800 m) and the dry lowlands (below 1500 m). The annual rainfall ranges from 500 to 1100 mm. The main SAFGRAD activities in this region focus on the improvement of sorghum and millet (finger and pearl millets) production, particularly in the semi-arid region.

II. NETWORK ACTIVITIES AND ACHIEVEMENTS

2.1. Purpose and Objectives

The main purpose of networking among member countries of SAFGRAD is to solve common problems of food production by judiciously pooling together scientific resources. Realizing the different levels of research capabilities among NARS member countries, SAFGRAD has adopted the collaborative mode (networking) to be central to its activities, since the "critical research mass" necessary to sustain agricultural development was attainable only at the regional level. Networking as a regional strategy provided the mechanism for sharing resources, scientific talent, and technical knowhow in order to attain common goals, such as meeting the food, shelter and energy demands of the growing population.

There are several barriers to agricultural progress in Africa. These include, among others, inconsistent or unfavourable government policies as well as weak research and extension institutions that are frequently unable to verify, validate and adopt technologies. Sustainable agriculture that could lead to self-reliance in food supply requires the support of minimum *levels of scientific research based upon adequate research infrastructure and well trained, motivated scientific personnel. The specific objectives of networking include the followings:*

i) To efficiently utilize existing research talents and facilities to attain a "critical research mass" at regional level to enable NARS to solve widely-shared problems of agricultural production, and sustain viable national programmes.

ii) To identify research priorities of common interest, based on constraints of regional dimension and to ensure that research remains focussed to solve farmers' problems.

iii) To enhance the generation, evaluation and exchange of germplasm and also to facilitate mobility of scientists.

iv) To facilitate exchange of technical information and interchange among participating member countries.

v) To coordinate research activities in order to avoid duplication or overlapping of research efforts.

2.2. Network Structure and Functions of Management Entities.

The OAU, through its Scientific, Technical and Research Commission, under which networks and other SAFGRAD activities are implemented, provided the political umbrella and legal framework across geopolitical boundaries. The SAFGRAD Coordination Office (SCO), as an OAU affiliated agency, played a critical role in coordination of research activities and the enhancement of the development of scientific and research management leadership among NARS. The management entities of SAFGRAD II are the Council of National Agricultural Research Directors, the Oversight Committee, and the Steering Committees of respective networks.

2.2.1. The Council of National Agricultural Research Directors (Council of NARD)

The Council, comprising agricultural research directors of the 26 member countries of SAFGRAD, provided policy guidance towards resolution of common research problems of regional dimension. Some of the salient deliberations of the two meetings of the Council include:

a) The First National Agricultural Research Directors Conference.

To activate the network entities as structured in SAFGRAD II, the first Conference of the Council took place in February 1987 in Ouagadougou (Burkina Faso). It provided policy input into SAFGRAD programmes and activities from the perspectives of member countries as summarized below:

i) Established policy and operational framework for the networks.

ii) Approved the collaborative mode (networking) as the main strategy for regional research cooperation.

iii) Urged the SCO to undertake an impact assessment study of the Accelerated Production Programme in some SAFGRAD member countries.

b) The Second Conference of the Council of NARD.

The second Conference took place in February, 1989 in Ouagadougou, Burkina Faso. During this Conference, the Council:

i) Elaborated and approved guidelines for the management of networks.

ii) Provided guidance for channelling network resources to participating NARS.

iii) Urged the SCO to facilitate the development of the SAFGRAD Network Strategic Plan by NARS scientists and research managers.

iv) Stressed proper linkages between research and extension.

2.2.2. The Oversight Committee (OC).

The Oversight Committee of SAFGRAD, established in February, 1987, is directly responsible to the Council of NARD. It monitors the implementation of SAFGRAD project activities; appraises network performance, and addresses policy and administrative issues related to network development. The Oversight Committee consists of seven members elected on their individual competence in agricultural research and/or management or in agricultural research experience at university level. By December, 1991, the OC had held seven meetings. Although its activities since 1987 are reported in greater detail elsewhere (26), the Committee:

i) Monitored the implementation of programmes of the networks.

ii) Thouroughly reviewed the draft document of the SAFGRAD Strategic Plan.

iii) Executed internal appraisal of the Networks.

iv) Served as "Board of Management" for the SAFGRAD Project.

v) Provided guidance on the modality for accepting other networks under the SCO management.

vi) Reviewed the activities of SAFGRAD Collaborative networks.

2.2.3 The Steering Committees.

Technical leadership of the networks was provided through the Steering Committees (SCs) each comprising 5 to 8 eminent NARS scientists. The SCO, IARCs, CIRAD, INSAH and other relevant organizations served as observers in Steering Committees of networks. Close to 40 scientists from over 15 countries have served in the Steering Committees of various networks. The Steering Committees started their deliberations in March 1987, during the General Workshop Assembly of NARS scientists, by reviewing constraints to, and research priorities of, food grain production which were submitted by national programmes.

As summarized in Annex 5, the SCs of the respective networks met approximately twice a year to address network issues and monitor the implementation of network programmes. Although the agenda for the SC meeting varied among networks, the following were the major deliberations:

i) Thoroughly reviewed coordinators' reports vis-à-vis planned activities of network programmes.

ii) Reviewed results of collaborative reseach projects vis- à-vis Lead Centres' responsibilities and provided technical directions.

iii) Assessed results of regional trials and provided guidelines for the comprehensive analysis and interpretation of research results.

iv) To a certain degree, reoriented network programmes towards the needs of weak NARS.

v) Made budget reviews, allocated available funds to projects, and provided support to NARS research .

vi) Organized Scientfic Working Groups to review collaborative projects and to facilitate in-depth multidisciplinary research to resolve specific problems of food grain production.

vii) Facilitated joint network agronomy seminars and subject matter technical consultancy services among NARS.

viii) Interacted with IARCs in order to optimize their technical support and to influence their research agenda.

Since March 1986, the SCs of Maize, Sorghum and Cowpea Networks have held 10 meetings each, i.e. one meeting every six months (one before the beginning of the crop season and the second during or soon after harvest). EARSAM has held nine Steering Committee meetings which were generally organized together with monitoring tours. This arrangement has its own advantages and disadvantages. While it enabled the Steering Committee to jointly evaluate the performance of regional trials and progress of collaborative projects at field level, these two activities were not only overstreched but most of the monitoring tour participants were also members of the Steering Committee.

2.3. Networks' Research Priorities and Strategies

The systematic identification of constraints to the production of food grains across geopolitical boundaries were the basis of prioritizing research projects of network programmes.

Global constraints to the production of sorghum in West and Central Africa were collated during several workshops in 1985/86. Researchers in Eastern Africa also identified the major constraints to sorghum and millet production during their 1986 regional workshop. Similarly, the maize and cowpea researchers of West and Central Africa documented the major problems affecting the production of these crops during their 1987 workshop. The similarity of food production constraints convinced participating

NARS to create collaborative research networks in order to mobilize scientific talents and resources of member countries. It was realized that food production problems transcend linguistic and cultural barriers as well as political frontiers. The collaborative mode has been adopted to facilitate large exchange and joint evaluation of technologies in different ecological zones.

Networks' programme priorities reflect, in aggregate, national research and development needs. As depicted in Fig. 2, the identification of research priorities at national level was based on the qualitative data obtained from some sort of reconnaissance and on-farm socio-economic surveys, review of the extension and rural development programmes, annual research reviews and through occasional farmers' participation. Although the capacity to undertake the above mentioned surveys varied considerably among countries, the process is repeated at regional level. The Networkshop Assembly of NARS researchers, normally held in alternate years, was an important technical forum both to facilitate the exchange of technical information and to identify and prioritize constraints to production of food grains.

Those constraints of regional dimension became the basis for setting research priorities and formulation of network programmes. It was evident that several NARS had certain comparative advantages to contribute to research activities of respective networks while, at the same time, benefitting from research efforts of alleviating common constraints to production of food grains. The major concerns of the SAFGRAD II strategy have been:

i) To build upon the research progress made during SAFGRAD I in the generation of elite germplasm and related technologies for production of food grains in three ecological zones (Sahel, Sudan and northern Guinea savannas); ideally the cultivars should withstand different biotic, abiotic and physical stresses.

(12)

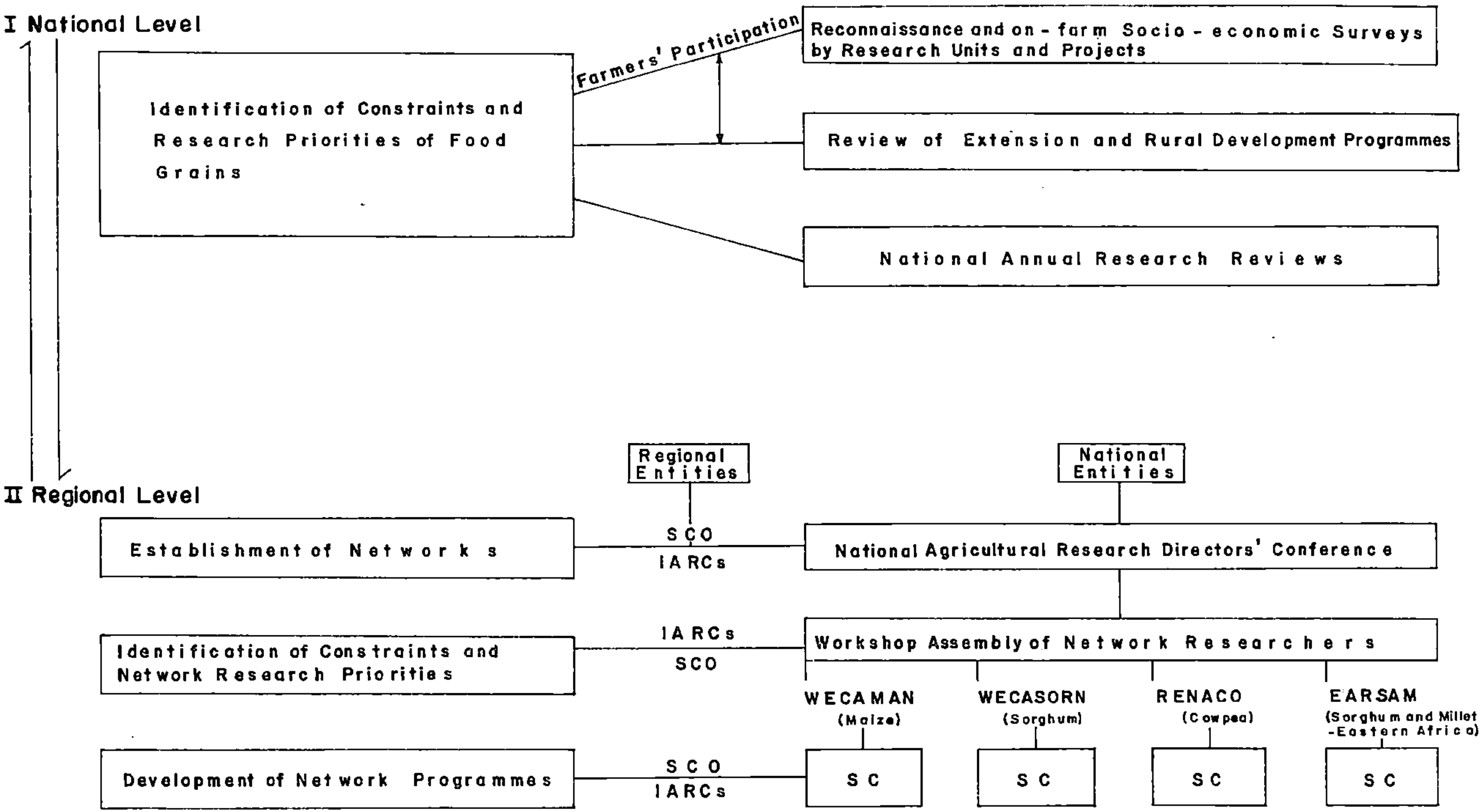
ii) *To enhance the development of indigenous research capabilities and to intensify exchange of germplasm and facilitate research cooperation among NARS as well as between NARS and IARCs.*

Assessment of NARS research capacities by each network resulted in the stratification and categorization of national systems into Lead Centres and Technology Adapting NARS. Thus, given the widely different levels of NARS research capabilities, a strategy was adopted whereby the relatively strong national programmes accepted research responsibilities to serve as Lead Centres in specific research areas in which they had comparative advantage. Each network has developed four to six such Lead Centres with responsibilities to screen and identify food grain (sorghum, maize, millet and cowpea) cultivars resistant to several biotic and abiotic constraints.

As summarized in Tables 1,2 and 3, close to 160 NARS researchers were involved in the generation of technology in 22 NARS Lead Centres of the four crop commodity networks. Essentially, research at Lead Centres focused on priority constraints in specific ecological zones. The network scheme enabled partners such as NARS and IARCs to streamline the various (germplasm) nurseries and regional variety trials in such a way as not to overburden NARS, particularly the weak national programmes. The strategy enabled technology adapting countries to concentrate their efforts on adaptive research.

A comparative advantage has been realized by pooling together the research resources of both strong and weak national programmes as well as those of the IARCs in alleviating common constraints to food grain production in the region. Furthermore, technology adapting NARS were assisted through consultation visits by network coordinators and the more experienced members of the respective steering committees. Coordinators have also arranged special research support from IARCs to NARS as reported elsewhere.

Fig. 2 Identification Process of Network Research Priorities



2.4. Generation and Diffusion of Technology via Networks

Collaborative projects were formally started in 1988. More than 25 projects were implemented by Lead NARS Centres of the crop commodity networks. Major emphasis was placed on screening and developing technologies that would alleviate various biotic and abiotic stress factors such as Striga, drought, soil fertility, moisture stress, insect pests, and diseases. Attention was also given to improvement of nutritional value of the grains and their agro-industrial uzes. Whereas the IARCs have provided broad germplasm and related technologies, the Lead and Associate NARS Centres of the respective networks conducted applied and adaptive research.

Through the resident research (1977-86) programme of the IITA SAFGRAD I, programme technologies suitable for semi-arid ecology were generated in collaboration with IITA for the improvement of maize and cowpea; and ICRISAT, for the improvement of sorghum and millets. Soil and water retention technologies were also developed.

As shown in Fig. 3, the sources of germplasm used in regional trials have varied among networks. For example, for the West and Central Africa Sorghum Network, 30% of the germplasm diffused via the network was contributed by different national programmes, the remaining 70% being provided by ICRISAT. In the case of the Eastern African Regional Sorghum and Millet Network, the eight network member countries contributed 85% of the germplasm, while ICRISAT and other organizations contributed about 15%. It must be noted that the ICRISAT Regional Sorghum and Millet Improvement Programme which provides the technical support for EARSAM is a relatively young programme.

The maize and cowpea resident research programmes were fully developed once IITA provided technical backstopping to OAU/STRC-SAFGRAD for development of technologies for the semi-arid ecologies. Thus, sources of germplasm for diffusion through the Maize Network during SAFGRAD II were: the IITA/SAFGRAD Programme (55%), IITA/Maize Programme, Ibadan (30%), and participating NARS (15%). This effort has expanded maize production in the northern

(14)

Guinea savanna and Sudano-Sahelian zones of West and Central Africa. Similarly, the sources of germplasm for the Cowpea Network were: participating NARS (20%), IITA/SAFGRAD Cowpea Programme (50%) and IITA Cowpea Programme, Ibadan (30%).

2.4.1. Collaborative Research Project Activities

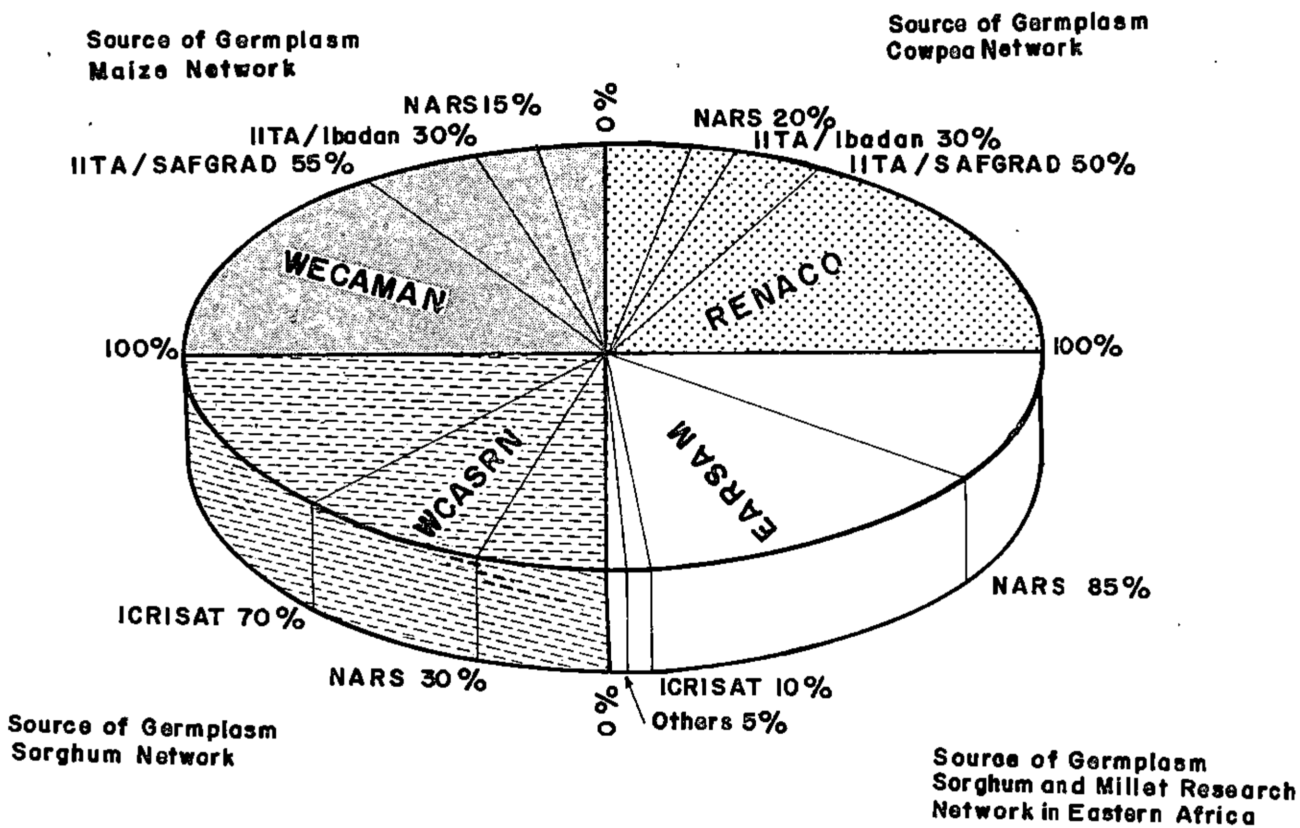
The collaborative research projects, summarized in Tables 1,2 and 3, were developed to provide solutions to production constraints of common interest. The mechanism optimizes the research strength and comparative advantage of strong NARS (Lead Centres) which are relatively endowed with qualified research personnel, infrastructure, facilities and ecological potentialities for the generation and evaluation of technologies. These NARS centres not only accepted regional research responsibilities to solve problems of food production in their specific areas of research competence, but they also shared their research results with other member countries, particularly the weaker national programmes (Technology Adapting NARS). Furthermore, the four to six Lead NARS Centres of each network are considered as centres of excellence and anchor of the research activities. The brief discussion below elucidates some of the achievements attained through the implementation of collaborative research projects.

(i) West and Central Africa Sorghum Research Network (WECASORN) and Eastern Africa Regional Sorghum and Millet (EARSAM) Network.

The collaborative project activities of WECASORN and the EARSAM network include leaf anthracnose (Colletotrichum graminicola), a major disease in West, Central and Eastern Africa. The Burkina Faso and Ethiopia Lead Centres have identified resistant sorghum cultivars to this disease in their respective regions. In cooperation with ICRISAT, these cultivars as well as the extent of the variability of the anthracnose pathogen are being further evaluated.

Long smut of sorghum is another important disease both in West and Eastern Africa. The Kenya Agricultural Research

Fig. 3 Diffussion of Germplasm Via Networks



Source — Final Evaluation Semi-Arid Food Grains Research and Development, July. 1991.

(15)

Institute (KARI), as a Lead Centre for EARSAM, has developed screening techniques for the disease and identified 18 resistant lines. Furthermore, the resistance of IS 8595 sorghum cultivar was confirmed. Similarly, the Niger National Programme served as Lead Centre of WECASORN to screen sorghum cultivars for resistance to long smut. The screening technique has not yet been fully developed since the project encountered logistic difficulties in 1989. Some progress was reported the following year when 11 out of 75 genotypes appeared to be highly resistant to long-smut, from natural innoculum.

Striga is one of the major constraints to the production of food grains throughout sub-Saharan Africa. Its depressing effect on food production has become quite substantial. Within EARSAM Network, 25 resistant sorghum genotypes were identified by the IAR, Ethiopia; the most promising cultivars were SAR-24, Gambella 1107, N-13, ICSV-1006 and ICSV-1007. The Lead Centre in Sudan focused on the development of an integrated Striga control management package (i.e. breeding, chemical control and agronomic practices). Cameroon served as Lead Centre for WECASORN to screen sorghum cultivars for resistance to Striga. Several resistant genotypes have been identified. Results of the West African Sorghum Striga Resistance Trials have indicated IS 9830 and ICSV 1007 BF as promising lines to Striga resistance.

Evaluation of sorghum for nutritional quality and for industrial uses (such as brewing) has been one of the project emphasis of both the EARSAM Network and WECASORN. Cultivars with higher ratings for food quality have been identified. For example, in Nigeria, the local variety, Farafara, was found suitable for wheat-sorghum composite bread and confectionery.

Evaluation of nutritional and food qualities of sorghum in Eastern Africa was carried out in collaboration with Institute of Agricultural Research (IAR), Ethiopia; University of Nairobi, Kenya; and the Food Research Centre, Sudan. In a study of the physicochemical characteristics and dehulling quality of 16 selected sorghum cultivars (representing the varieties that are commonly cultivated in Ethiopia, Kenya and Sudan), a wide variation was observed among the cultivars ( ). The organoleptic qualities of such traditional foods as injera and nifro (Ethiopia), ugali (Kenya), and kisra (Sudan) have been evaluated and variations found in the quality of foods made from each cultivar. Grains of SPV 475 (India), Dabar (Sudan), and IS 24129 (Tanzania) had comparatively higher ratings for overall food quality.

With regard to insect pests of sorghum, chilo-stalk borer (Chiloa partellus) is one of the important pest problems in Eastern Africa. In cooperation with the Ministry of Agriculture of Somalia and with the technical support of ICRISAT, the EARSAM Network has established facilities to screen sorghum cultivars for resistance to the stalk borer. The purpose of the project has also been to develop agronomic/cultural practices to control the pest.

On the Western side of the continent, sorghum head bug (Eurystylus marginatus) is an important economic pest. Mali, as the Lead Centre, has reported results that could interest other members of WECASORN. It was observed that, at least under Sudano-Sahelian conditions, the insect was more abundant towards the end of September and early October; thus, early planting of sorghum is a possible control measure. In addition, about 25 lines were reported to be resistant to the head bug.

The EARSAM Network initiated a project to control blast disease on finger millet in 1990. The programme was based largely on collections and accessions obtained from Katumani genetic resources unit of KARI. The Network has screened about 250 lines of finger millet for resistance to the disease. A regional blast nursery has already been established.

As is apparent from the above, some of the sorghum production constraints are important throughout the semi-arid ecology of West, Central and Eastern Africa. Interestingly, WECASORN and the EARSAM Network have developed similar collaborative projects to tackle these constraints. In addition, both networks have *established, differently, Scientific Working Groups to assess these similar projects. In future, inter-network activities or Scientific Working Groups on similar projects would not only facilitate the exchange of technical information, germplasm, and methodologies, but could also forge closer cooperation among participating national research institutes.*

(ii) West and Central Africa Cowpea Research Network (RENACO).

The West and Central Africa Cowpea Network (RENACO) has facilitated the development and diffusion of cowpea varieties suitable for adaptation in three main ecological zones in West and Central Africa (i.e. the northern Guinea, Sudan and Sahel savanna zones). Collaborative research projects were developed to alleviate major constraints to cowpea production. As indicated in Table 2, the Cowpea Network has collaborative research projects in six relatively strong national programmes that serve as Lead NARS Centres. A number of cowpea varieties resistant to Striga (Annex), drought, aphids, etc. were identified. The drought resistant cowpea cultivars developed by Lead Centres include SUVITA-2, 58-57, KVx 30-309-6 G, TN 88-63, KVx-396-4, and IS86-275. The aphid resistant varieties developed and contributed by IITA include IT82E-2S, IT835-742-2, and IT856-3755, while some of the bruchid resistant cultivars developed by Burkina Faso and IITA are IT845--275-9, KVx 30-6467-6-10K, and IT845-22461 ( ).

Affordable technologies to control storage insect pests were developed by Cameroon and Ghana as Lead Centres. These studies showed that local plant products (i.e., neem seed oil, groundnut oil, black paper powder and ash) could be used to control cowpea storage pests. In Nigeria, dual-purpose cowpeas (producing both grain and fodder), adapted to northern Guinea savanna zones, were developed. Agronomic research at Samaru, Nigeria also established that the application of phosphorus up to 60 kg P_2O_5/ha increased cowpea yields. In Senegal, three cowpea lines with combined resistance to thrips, bacterial blight and virus diseases were identified. The IAR, Samaru (Nigeria) and IITA, *Kano Substation (Nigeria) have collaborated to elucidate the genetics of inheritance to Striga and Alectra in the cowpea line, B301. This has facilitated the incorporation of resistance to the two parasites into agronomically acceptable cowpea cultivars.*

(iii) The West and Central Africa Maize Research Network (WECAMAN).

The cultivation of maize has substantially expanded in the semi-arid zones (Sudan and northern Guinea savannas) during the last decade. Maize production has good potential in this ecology in which large increases could be attained through innovative agricultural development policies that enhance the application of improved production technologies.

The SAFGRAD Maize Network has taken a pragmatic approach in expanding maize cultivation in the semi-arid ecology, primarily to fill "food gaps" due to low yields and lengthy growing season of traditional crops such as sorghum and millets.

Maize research priorities encompassed development of short-season maturity varieties with resistance to Striga, drought, insect pests, and diseases. Problems associated with low soil fertility and related agronomic practices have also received attention.

The Network promoted maize improvement within and among NARS through collaborative research project activities. Six major collaborative projects were developed at Lead Centres. These research activities coordinated by the Network have enabled NARS to identify suitable germplasm for their own climatic conditions. Capability in maize streak resistance "conversion technology" has been strengthened in Togo and Ghana NARS. In Côte d'Ivoire, network-supported research on the identification of sources of stem borer resistance in maize of different periods was started. The extent of damage on maize crop by three species of borers was assessed, while several accessions of maize were screened. In Cameroon, the development of drought tolerant and Striga resistant maize was given priority attention. In Nigeria and

Table 1. Collaborative research project activities of Maize Network in West and Central Africa.

	Project	Lead Centre Country	Number of Researchers	Remarks
i	Breeding maize for different maturity groups; drough resistance and Striga tolerance.	1.0. Cameroon	12 (3 Ph.D., 6 M.Sc & 3 IA*)	Developed drought tolerant synthetics from Pool 16 DR and from IITA and SAFGRAD sources. Agronomic management practices for early and extra early maize cultivars were developed. CMS 8806 and Pool 16 DR released.
ii	Development of early and extra-early maize with drought resistance.	2.0. Burkina Faso	5 (1 Ph.D.,3 3e Cycle & 1 IA)	In collaboration with Burkinabe National Programme developed several drought resistant cultivars being utilized in the regional trials. Several extra early maturing maize cultivars (less than 82 days to maturity developed. Streak resistance incorporated into TZEE-W, TZEE-Y, and CSP Early.
iii	Screening maize cultivars to stem borer resistance	3.0. Côte d'Ivoire	5 (5 M.Sc)	Network provided assistance to develop research facilities. Identified 3 species of stem borers in Northern Côte d'Ivoire Screened several accessions of maize.
iv	Screening for streak resistance in maize cultivars.	4.0. Togo	4 (2 Ph.D., 1 3eCycle & 1M.Sc)	Improved facilities for screening streak resistance. Two maize population are being improved for streak resistance. Varieties EV 8443-SR and Ikenne 81495R, released.
v	Development of maize of different maturities and with streak resistance.	5.0. Ghana	10 (4 Ph.D. & 6 M.Sc)	Various populations of maize for different purposes with white dent, yellow/flint dent and different maturity groups (120, 105 and 95 days) developed. Incorporated streak resistance to standard maize cultivars. Varieties SAFITA-2, Drokes SR, and Abelehee released.
vi	Fertiliser requirements for maize and cowpea mixture.	6.0. Nigeria	8 (8 Ph.D.)	At Samaru, Northern Nigeria-Maize grain yield increased with the application of up to 75 kg N/ha and 40 kg P_2O_5/ha. For cowpea, N application depressed grain yield while responding to P, up to 80 kg P_2O_5/ha.

* IA Ingenieur Agronome.

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Table 2. Collaborative research project activities of Cowpea Network in West and Central Africa.

	Project	Lead Centre Country	Number of Researchers	Remarks
i	Breeding for drought, Striga, insect pests and disease resistance.	1.0. Burkina Faso	5 (2 Ph.D., 1 3^{e} Cycle & 2 IA*)	Identified cowpea lines with combined resistance to insect pests and diseases. These include KVX 402-5-2, KVx 402-19-1, KVX 402-19-5 and KVX 396-4-5-20. Developed Striga resistant cowpea cultivars. These include SUVITA-2, TN27-80 KVX 61-1, KVX 402-5-2.
ii	Control of cowpea storage insect pests.	2.0. Cameroon	2 (2 M.Sc)	The following storage technologies developed: a) Use of a plastic cover and an insulating cushing made of cowpea pod husks or any other plant material to permit temperature to rise up to 65°C to kill the bruchids; b) Use of ash: 4 volumes cowpea + 3 volumes ash mixed together destroyed weevil population. c) Use of botanical products: neem seed oil protects cowpea grain from bruchids.
iii	Development of cowpea for sub-humid and coastel zones and control of storage pests.	3.0. Ghana	10 (4 Ph.D., 5 M.Sc & 1 B.Sc)	Line CR-06-67 was the most promising. Four plant product namely neem seed oil, Jatropha seed oil, groundnut oil and black pepper powder were as effective as acetellic 2% dustin protecting cowpea grain from weevils for at least six months.
iv	Development of drought, Striga, insect and disease resistant cowpea cultivars.	4.0. Niger	9 (4 Ph.D. & 5 IA)	Identified cultivars resistant to Striga, namely: TN 93-80, TN 121-80 and B 301.
v	Development of improved cowpea cultivars resistant to insect pests, Striga control through crop management and control of seed borne diseases.	5.0. Nigeria	8 (5 Ph.D. & 3 M.Sc)	Suitable dual purpose cowpea cultivars developed for Northern Nigeria. Land races resistant to insect pests identified. Increased levels of application of phosphorus up to 60 kg P_2O_5/ha improved cowpea yields. IT86-D-1056 was found to combine resistance to Septorial leaf spot and scob IAR/IITA determined genetics of importance to Striga.
vi	Development of multiple pest/disease resistant cowpea cultivars and breeding for drought resistance.	6.0. Senegal	3 (1 Ph.D. & 2. M.Sc)	Identified 3 lines (IS 87-416, IS 87-432 and IS 87-437) with combined resistance/tolerance to insect pests (such as thrips) and diseases, e.g. bacterial blight and virus. Lines IS 86-275 and B 89-504 were also observed resistant to virus and bacterial blight.

* IA Ingenieur Agronome.

Cameroon, improved agronomic packages for early and extra early maize varieties were developed ( ).

In Burkina Faso, where the Network Headquarters is situated, several extra early maturing maize cultivars were developed and have been included in the regional trials. Furthermore, streak resistance has been incorporated into early maize cultivars such as TZEE-W, CSP and TZEE-Y. The Ghana national maize programme has developed maize of different maturity periods, for example, maize cultivars that mature within 120, 104 and 95 days.

2.4.2. Facilitating the Release of Varieties for Farmers' Use through Regional Trials

An important mechanism for direct exchange and evaluation of elite germplasm has been the regional trials conducted by member countries of various networks. The importance accorded to regional testing of improved technologies, as one of the key activities of the networks, is not only because of the need to popularize germplasm and related technologies available in various NARS and IARCs, but also because of the necessity to accelerate verification and validation of the performance of technologies under different environmental and socio-economic conditions.

(i) West and Central Africa Sorghum Research Network.

The regional trials and nurseries dispatched and the results received by WECASORN from 1987 to 1991 is summarized in Table 4. It is evident from this table that Nagawhite variety from Ghana gave the highest yield among the early maturity sorghum varieties evaluated in 1987, 1988, and 1989; its grain yield varied from 2.8-3.5 t/ha. ICSV 1063 yielded highest among the medium maturity varieties, yielding between 2.6 t/ha and 3.3 t/ha. Among the hybrids, ICSH 567 ranked first in 1988 and 1989, with mean yields of 3.3 and 3.7 t/ha, respectively (8).

In 1988, the West Africa Sorghum Striga Trial consisted of 11 entries which had been tested by both ICRISAT in fields with *high Striga infestations, by NARS of Cameroon, Ghana, Mali, Niger, Nigeria, and Togo. The results of two years of observations showed IS 9830 and ICSV 1007 BF as promising lines for Striga resistance (9).*

During the past few years, WECASORN has made some modest impact in the overall effort for sorghum improvement in West and Central Africa. A number of improved sorghum varieties have been released. For example, S-35 (an improved sorghum cultivar) is grown by more than 5,000 farmers in the Far-North Province of Cameroon, while the same variety is cultivated by more than 15,000 farmers in the Sahelian zone of Chad ( ). The Framida variety, introduced in 1980s for its Striga resistance trait, has been cultivated in Burkina Faso (Manga region), Northern regions of Ghana, and Togo.

In Mali, ICSV 1063 BF and ICSV 1079 BF were tested on farmers' fields; ICSV 1063 BF produced superior grain yields over the local variety. This variety was tested in several villages during the 1990 crop season. ICSV 11 IN and M 66118 have received greater attention in Ghana; ICSV 1063 BF and Mali Sor 84-1 were included in on-farm tests by extension agencies in Côte d'Ivoire. Promising sources of resistance to the prevalent leaf diseases and to Striga have been identified through disease observation nurseries and Striga trials.

Table 4. Rating and/or yield of top yielding cultivars (t/ha) of West African Sorghum Adaption Variety Trial (WASVAT).

YEAR	Early maturity trial		Medium maturity trial		*Striga* resistance trial	Disease nursery	West African Sorghum Hybrid Trial (WASHAT)	
	Entry	Yield	Entry	Yield			Entry	Yield
1987	Nagawhite	2.8	ICSV1063BF	2.58	NS	13 promising lines identified	ICS4336	2.8
1988	Nagawhite	3.58	ICSV1063	3.34	NS			
	Nagawhite	2.85	ICSV1171	2.37	ICSV1001BF			
					ICSV1007BF	Three genotypes	ICSH507	3.31
					ICSV1164BF	were identified.	ICSH507	3.66
					IS9830			
1990	CE196-7-2-1	2.53	CS85	2.09	Framida and	84S109 and IS3443	ICSH89008NG	3.68
					ICSV1078	were resistant to	ICSH89012WG	3.56
						leaf diseases	ICSH89007NG	3.54
1991								

(ii) Eastern Africa Regional Sorghum and Millet Network.

The regional trials executed by EARSAM are shown in Table 6. The low-land and intermediate altitude regional yield trials comprised 25 and 16 entries, respectively, while the finger millet elite trials consisted of 16 entries. The participation of NARS in the regional trials appeared to have been influenced by the importance of the crop to particular ecological zones. Thus, the low-land trials, intermediate altitude trial and the finger millet trials were conducted by 8, 5 and 4 NARS, respectively. As depicted in Fig. 3, there has been substantial exchange of sorghum germplasm among NARS in the region.

Among low-dryland elite varieties, Seredo produced the highest mean yields (3.37 t/ha) across locations, being followed by ICSV 112, CR 35-5 and KAT/83369 which averaged 3.42, 3.39 and 3.31 t/ha, respectively. The promising sorghum cultivars at the intermediate altitude zone were IS9302 (from Ethiopia), Nyirakkabuye and Amasugi (both from Rwanda) which yielded 3.33, 2.61 and 2.54 t/ha, respectively, across locations.

Of the entries in the ELite Finger Millet Trials, the variety, Gulu, (from Uganda) was the highest yielder across locations (with an average of 2.6 t/ha). Some entries (e.g. 4-10, P-227 and Engency). were observed to have tolerance to head blast.

With regard to sorghum varieties grown by farmers in Eastern Africa, the variety Seredo has been released in Uganda, Kenya and Ethiopia; in all three countries, it is grown by many farmers. Other varieties such as Serena, Lulu and Tegemeo are largely cultivated in Tanzania. The varieties Melkamash, Gambella 1107 and Dinkmash are the major improved cultivars grown by farmers in Ethiopia ( ).

In Sudan, a number of improved varieties have been released. In the early 1980s, the development and release of the sorghum hybrid, the Hageen Dura-1, through the collaborative effort of ICRISAT and the National Research Programme of Sudan, brought new

Table. 5 Germplasm Diffusion through Regional Trials of Eastern Africa Sorghum and Millet Research Networks 1989-1990

Type of Regional Trial	Number of Entries	Set of Trials	Number of Countries	Top Yielding Cultivars Tons/ha	Germplasm Sources *
1·0 Elite Sorghum Yield Trial Lowland Zones	25	12	8	Seredo - 3·51 ICSV-112 - 3·42	Ethiopia (6), Tanzania (3), Sudan (3), Uganda (2), Kenya (2), Rwanda (2), Somalia (2), Burundi (1) and ICRISAT (4).
2·0 Elite Sorghum Yield Trial Intermediate Zones	16	8	5	IS 9302 - 3·33 Nyarakabuye 2·60 Amarugi - 2·54	Ethiopia (5), Uganda (5), Rwanda (2), Tanzania (2), Kenya (1), and ICRISAT (1).
3·0 Elite Finger Millet Trial	16	5	4	Gulu E. - 2·08 P224 - 1·98 ENG - ENY - 1·97	Uganda (1), Kenya (2), and Ethiopia (3).

* Figures in parenthesis indicate germplasm contributions to regional trials by network member countries and ICRISAT.

hopes for substantial increase in sorghum production in the country.

On-farm verification trials of sorghum variety, SRN-39 (since 1986), in collaboration with the Sudanese-Canadan project, expanded the production of this cultivar by farmers on about 45,000 ha in the Sim Sim and Gedarif regions. Farmers were convinced of the superiority of SRN-39 over local varieties in Striga infested fields ( ). SRN-39 having short stature, fits into mechanized farming in the Sudan. It is expected that more Sudanese farmers will continue to grow this cultivar in Striga infested fields.

(iii) West and Central Africa Maize Research Network.

Regional trials of the Maize Network have enhanced the broad evaluation of elite cultivars in different national programmes. Between 1987 to 1990, the Network coordinated three types of regional trials. While the SAFGRAD trials concentrated on the early and extra-early maize, the trials of late and intermediate varieties were coordinated by IITA. The Regional Uniform Variety Trials (RUVT) consisted of:

i) RUVT-1 Drought resistant, early maturing (85-90 days) varieties.

ii) RUVT-2 Intermediate and late maturing (105-120 days) varieties.

iii) RUVT-3 Extra early maturing (less than 82 days) cultivars.

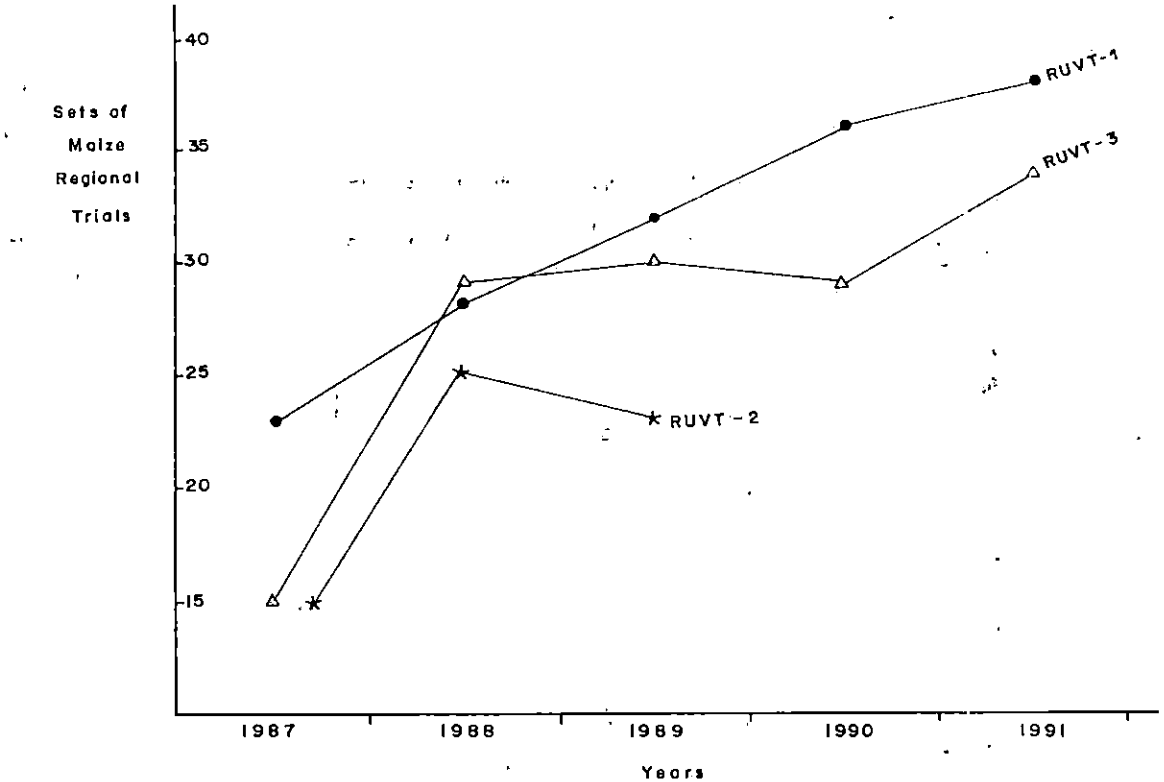
As shown in Fig. 4 and Annex 6, close to 350 sets of trials conprising about 35% each of RUVT-1 and RUVIT-3, and 30% of RUVT-2) were evaluated in 12-15 locations in network member countries. Participation in these regional trials has enabled national programmes to identify suitable cultivars for semi-arid climatic and soil conditions.

The short cycle varieties that have been developed by the Network are targeted to short growing seasons in which the crop could be harvested as green maize two months after planting, thereby filling "the food gap shortage" before the harvest of sorghum and millet. Agronomic research in Cameroon indicated that the extra-early varieties could also fit into the farming system of hydromorphic soils (vertisols) where it was reported to yield 5-7 t/ha at recommended plant density and soil management ( ) levels.

As indicated in Table 7, some of the maize germplasm exchanged through the Network was incorporated into the national maize improvement programmes of participating countries, particularly to develop early and extra-early cultivars. It must be noted that each country participating in the Network has its own established maize improvement programme basically funded from national and other resources. With its limited resources, WE-CAMAN played a catalytic role in intensifying scientific interaction and exchange of germplasm between NARS and IARCs and among NARS. This effort has paid off since maize germplasm and improved agronomic packages were made available to all participating countries.

Several maize varieties evaluated through the Network have enhanced the release of improved maize varieties in various countries(Annex 7). For example, in Cameroon, the variety TZB/TZB-SR, covers 15% (or 75,000 ha) of the maize production area with an estimated yield of 90,000 tons. In the Far-North Province of Cameroon, where sorghum and millet are the major staple food crops, the area planted with maize has nearly doubled (about 35,000 ha) due to the availability of short cycle maize varieties (e.g. CMS 8704, CMS 8806 and Pool 16 DR) that are being cultivated by more than 1000 families. The good acceptance of the short cycle maize cultivars has been attributed to their earliness and good "taste" of the green maize.

In Burkina Faso, maize is the third most important crop. About 68% of the maize area (206,000 ha) is occupied by the improved cultivars ( ). The variety, EV 8442-SR, occupies 60%



Regional Uniform Variety Trials (RUVT)

	1987	1988	1989	1990	1991	Total
RUVT - 1	23	28	32	36	38	157
RUVT - 2	15	25	23	-	—	63
RUVT - 3	15	29	30	29	34	137

Fig. 4 Distribution of three types of Regional Maize Trials

RUVT-1 – Drought Resistant, Early Maturing Varieties
RUVT-2 – Intermediate and Full Season Streak Resistant Varieties
RUVT-3 – Extra Early Maturing Varieties

–Please note the Steering Committee of the Maize Network Recommended that RUVT-2 Trials be Coordinated by the IITA, Nigeria Maize Programme as of 1990.

Table 6

~~Annex 20~~. Utilization of maize technologies obtained through the Network by NARS in West and Central Africa.

Country	Germplasm Development	Adoption/On-Farm Trials
1. Benin	Farako-Bâ 85 TZSR-W-1, TZB-SR DMR-ESRW, Pool 16 DR, TZPB-SR, EV 8328-SR, SEKOU 85 TZSR-W-1	Pirsaback 7930-SR, TZESR-W, DMR-ESRW, SEKOU 81 TZSR-W-1
2. Burkina Faso	EV 8322-SR, Pool 16 DR, EV 8330-SR, EV 8331-SR, Maka	22-SR (= EV 8322-SR), SAFITA-2, KPB (= 30 SR), KPJ (= 31 SR), Maka
3. Cameroon	(a) Pool 16 DR, Maka, CSP, DMR-ESRY, TZEF-Y (b) Uses Tied and Simple ridges for selecting for drought resistance.	CMS 8806 (= DMR-ESRY), Pool 16 DR.
4. Cape Verde	-	Maka
5. Chad	-	TZESR-W, TZB-SR, CMS 8602 (= 31SR)
6. Côte d'Ivoire	TZSR-Y-1, Maka, Pool 16 DR	Pool 16 DR, Maka
7. Ghana	(a) Pool 16-SR, 31-SR, 43-SR 49-SR (b) Screening techniques for streak resistant varieties	SAFITA-2, Dorke-SR (= 31 SR) Abeleehi (= 49-SR), Okomasa (=43-SR)
8. Guinea	DMR-ESRY, Pool 16 DR CSP Early, DR Comp Early	Ikenne 83 TZSR-Y-1
9. Guinea Bissau	-	TZESR-W, TZESR-Y
10. Mali	-	SAFITA-2, DMR-ESRY, TZEF-Y
11. Mauritania	Maka, Capinopolis 8245	CSP Early, CSP Early x L. Raytiri
12. Niger	Pop 31-SR, J.F. Saria, Maka, Pool 16 SR	Maka, Pop 31-SR, TZESR-W
13. Nigeria	TZB-SR, TZSR-Y-1, DMR-ESRW, DMR-ESRY	TZB-SR, TZSR-Y-1, DMR-ESRY DMR-ESRW, TZPB-SR
14. Senegal	Pool 16 DR, Maka	Ikenne(1) 8149-SR Maka, Pool 16 DR
15. Togo	(a) Ikenne 8149-SR, EV8443-SR TZESR-W x Gua 314, Pool 16 DR, Maka (b) Screening techniques for streak resistant varieties.	EV 8443-SR, Ikenne 8149-SR

source ( )

of the maize area (about 123,600 ha) with an estimated production of 120,600 tons. SAFITA-2, one of the earlier introduced varieties, is reported to occupy 5% of the maize area (i.e. 10,300 ha) with an estimated yield of 10,000 tons. The variety, KPB (TZESR-W), occupies about 3% of the maize area with estimated production of about 6000 tons. Other varieties currently being evaluated on-farm include KPJ (EV 8431-SR) and Pool 16 DR.

In Ghana, maize is the most important food crop. Maize grain production has increased from 560,000 tons in 1986 ( ) to 750,000 tons in 1989 ( ). Among improved maize cultivars, Okomasa is planted to approximately 35% of the total maize area with an estimated production of 400,000 tons. The second important improved maize variety, known as Abeleehi, covers 15% of the maize area with an estimated production of 50,000 tons. The Variety, SAFITA-2, which was released in Ghana as an early white dent cultivar is cultivated by 12% and 3% of farmers in Volta and Eastern regions of Ghana, respectively ( ). According to Global 2000 survey, SAFITA-2, a short cycle maize cultivar, is cultivated predominantly in Denu District of Ghana. At the national level, SAFITA-2 covers only 2% of the maize area with an estimated production of 16,000 tons ( ).

In Benin, the variety, TZB/TZB-SR, occupies 25% of the total maize area (i.e. 119,749 ha) with an estimated production of about 106,000 tons. Another variety, POSARICA-7843-SR, constitutes 10% of the total maize production (i.e. 47,900 ha) with an estimated production of 42,404 tons. Two other varieties that occupy 10% of the total maize production area are TZ SR-W and TZESR-W, with an estimated total production of 21,202 tons each. Furthermore, the variety Pirsaback 79 30-SR is cultivated on 3% of total maize area (i.e. 14,370 ha) with an estimated production of 12,720 tons. The variety, DMR-ESRW, was recently released while Across 85 Pool DR is being evaluated on-farm. FSR studies in Northern Benin, showed that the improved maize variety, TZB, fits well into the sorghum/maize intercrop system due to the different growth patterns of the crops which minimize competition ( ). Regarding cereal/legume associations, Crotalaria spp., as green manure, increased the yield of maize by 45% when incorporated into the soil ( ). The practice has been recommended for pre-extension tests as it involves minimal, additional labour.

In Mali, through the Maize Network Regional Uniform Variety Trials, promising extra-early varieties were identified. The varieties, TZESR-W, and SAFITA-2 are released cultivars that occupy 10 and 3% of the maize area with an estimated maize grain production of 22,000 and 6740 tons, respectively. DMR-ESRY and TZEF-Y, both short cycle cultivars, are currently undergoing on-farm testing. Improved maize varieties, including Tuxpeno and Tiementié, have been adopted by farmers in the Sudano-Guinean zone where more than 50% of the crop is produced. At Kita, Mali, where average rainfall is above 650 mm, top yielding short cycle maize cultivars include DMR-ESRW, Across Pool 16SR, and DMR-ESRY with average grain yields of 4.8, 4.7 and 4.63 tons/ha, respectively.

In Mauritania, maize production through irrigation extended to 11,303 ha by 1990 ( ). The Maka and Capinopolis 8345 varieties occupy 35% and 10% of the area under maize respectively. Pool 16 DR, a short-cycle maize cultivar, is currently undergoing on-farm testing.

In Senegal, maize production has increased to 133,000 tons on 105,000 ha. Improved varieties, such as Pool 16 DR and Maka, constitute 10% of the total maize production.

During the last 20 years, maize production in Togo has increased to about 245,000 tons on 258,000 ha. Improved streak resistant cultivars, Ikenne 8149 SR and EV 8443-SR, constitute 12 percent of maize production.

A number of short-cycle maize varieties are being tested on-farm in Chad, Guinea, Niger, Central African Republic, Côte d'Ivoire, and Cape Verde.

(iv) West and Central Africa Cowpea Research Network.

Cowpea production statistics with respect to improved varieties in various countries are virtually lacking. Recent feedback from a few countries indicated that Nigeria, Ghana, Senegal, Mauritania, Mali and Burkina Faso have expanded their production of improved cowpea varieties by about 250,000 ha.

As shown in Table 7, a number of improved cowpea varieties are being cultivated in various countries ( ). For example, in Northern Ghana, the variety, Vallenga (released since 1987) is cultivated on more than 20,000 ha with a yield of 800-1200 kg/ha under farmers' conditions. In Southern Ghana, the variety, Asontem, is largely cultivated on about 29,000 ha with an average yield of 1 ton/ha under farmers' conditions. The varieties, II8ID-1137 and II83S-818, are cultivated in the savanna zones of Ghana.

In Burkina Faso, the production of improved cowpea varieties is estimated at about 3% of the total production area ( ). The cultivars, TVx3236, KN-1, and SUVITA-2, are grown by several farmers. Varieties of cowpea of recent introduction to farmers include KVX61-1, KVx 396-4-4, KVx 396-4-5, and KVx 396-18-10.

Nigeria and Niger (with annual cowpea grain production of 850,000 and 271,000 t/ha, respectively) are known to produce about 50% of world cowpea production. However, it has not yet been established to what extent improved cowpea cultivars are utilized in these countries. In the savanna and forest zones of Nigeria, the production of variety SAMPEA-7 is known to cover an estimated area of 75,000 ha with an average yield of 600 kg/ha under farmers' conditions ( ). In the Sudano-Guinea savanna zone, cowpea varieties TVx 3236 and II8I-D994 are also cultivated.

Table 7. Cowpea cultivars released or about to be released from the Network efforts.

Country	Cultivars		Area of adaptation
	Released	To be released	
1. Benin	Vita-5	IT82E-32	Coastal zone
	IT81D-1137	Coastal zone	Coastal zone
	TXx 1850-01F	Transition zone	Transition zone
2. Burkina Faso	Gorom L. (Suvita-2)	KVx61-1	Sahel
	KN-1	KVx396-4-4	Sahel Sud. zone
		KVx396-4-2	Sudano-Guinean zone
3. Cameroon	Brl (IT81D-985)	IT81D-994	Sudano-Guinean zone
4. Chad	IT81D-994 KN-1 TVx3236	TN88-63	Sudano-Sahelian zone
5. Ghana	Asonteme (IT82E-32)		Transition zone
	Valenga (IT82E-16)		Guinea savanna zone
6. Guinea Bissau	IT82E-9		Guinea savanna zone
7. Mali	Gorom L. (Suvita-2)	KVx61-1	Sahel
	TN88-63	KVx61-74	Sahelo-Sudanian
	KN-1		Sudano-Guinean
8. Gambia	IT81D-994	-	Sudano-Guinean
9. Niger		KVx100-2 KVx30-309-6G KVx61-74 TN27-80	Sudano-Sahelian zone
10. Nigeria	Sampea-7 (IAR-48) Sampea-1 (IAR-339-1)		Sudano-Guinean Savanna zone
		TVx3236 IT81D-994	Sudano-Guinea Savanna zone
11. Senegal		IS86-275 B 89	Sahelo-Sudanian zone
12. Togo	Vitoco (IT81D-985) (Vita-5)	IT81D-1137	Coastal, transition and Guinea savanna zones
13. Central African Republic	KN-1 TVx 1948-01F		Transition and Guinea savanna zones

Cowpea production in Senegal, estimated at 30,000 ha, is largely planted to improved cowpea cultivars such as IS86-275 with an average yield of 600 kg/ha under on-farm test conditions. The cowpea variety, 58-146, from Senegal is produced in most regions of Togo. In Mauritania, improved varieties such as SUVITA-2, KVx 256-K17-11, and IT83S-343-5-5 are grown on about 3000 ha.

In Mali, a number of cowpea varieties were found suitable for production by farmers in various regions. More specifically, in the Seno plain, early maturing varieties such as SUVITA-2, Gorom-Gorom, TN-8863, etc. are increasingly cultivated by farmers. Furthermore, suitable packages of technologies for intercropping systems, for example, millet/cowpea, maize/cowpea, sorghum/groundnut, sorghum/millet, etc. have been developed.

(v) The Food Grain Technology Verification Project.

Since 1990, the African Development Bank support to the Food Grain Production Technology Project of SAFGRAD, has facilitated on-farm verification trials in eight countries. The major emphasis of the project has been to narrow the yield gap resulting from differences in the performance of similar technologies between on-research station and on-farm.

For example, in Burkina Faso, on-farm verification trials were conducted in 11 districts covering the three main ecological zones (Sahel, Sudan and northern Guinea savannas). With both improved and locally adapted cultivars, the trials showed that cowpea yield could substantially be increased. The varieties KVx-396-4-4, TVx 3236, KVx 61-1 and KN-1, a locally improved cultivar, were found promising in different provinces of Burkina Faso. Furthermore, the advantages of insecticide application (to control cowpea pests) were established on most of the sites where trials were conducted.

In Cameroon, the project emphasis has been to develop packages of agronomic practice for early and extra-early maturing maize cultivars. Under the conditions in Northern Cameroon, the results obtained showed that the highest yield was obtained when 2/3 of the Nitrogen fertilizer was top dressed 20-25 days after plant emergence. In Northern Cameroon, the effect of plant population on maize yield was investigated. Higher plant density (80 x 20 cm) was recommended in order to compensate for poor stand due to poor germplasm, lodging, soil insect damage, etc. With an early maize cultivar (DMR-ES-R-Y), tied and simple ridges gave the highest yields of 6.6 and 6.0 tons/ha, respectively.

Various cropping systems were evaluated in Northern Ghana. The grain yield of alley-cropped maize under pigeon pea varied from 1626 to 2030 kg/ha in Nakpa and Binda villages, respectively.

In Mali, an agronomic evaluation on the adaptability of early and extra-early maize cultivars was investigated. Some promising cultivars were identified for different locations in the country.

In Niger, improved and traditional millet/sorghum-based cropping systems were evaluated. It was observed that the yields of improved varieties in sorghum/millet mixtures under improved management (with application of phosphorus fertilizer) gave higher yields than traditional practice.

In Northern Nigeria, on-station agronomic trials included testing for appropriate varieties for sorghum/millet/cowpea mixtures; maize/cowpea cropping systems and determination of fertilizer rate (NPK) for maize/cowpea crop mixtures. The result indicated that cowpeas grown under KSU-8 (improved sorghum variety) yielded better than under a traditional variety, Farafara. Sorghum cultivar, KSU.8 yielded significantly more than the local cultivar, Farafara. In intercropping of maize/-cowpea, the yield of the legume was reduced substantially mainly due to moisture stress. With regard to effect of fertilizer on maize/cowpea cropping system, the results showed that grain yield of maize was increased with increased Nitrogen. In contrast, increased application of N, depressed the grain yield of cowpea significantly while positive cowpea yield response to phosphorus (P), up to 80 kg P205/ha, was obtained.

In Senegal, verification trials on millet production technologies were carried out in the three regions, namely Kaolack, Fatick and Diourbel. Under farmers' management conditions, improved millet variety (Souna-3) yielded significantly more than the local cultivars. The verification trials on cowpea consisted of four varieties (IS-86-275, Ndiambour, 58-57 and Bambey 21) and plant protection measures to minimize damage caused by insects (such as Amsacta moloney) which cause severe damage in Louga. In Thilmakha and Sine, IS 86-275 yielded the highest, with an average grain yield of 757 and 675 kg/ha, respectively. Across the four villages evaluated, the mean yield of IS 86-275 was 512 kg/ha.

In Northern Togo, trial results suggested that appropriate varieties of cowpea and sorghum for intercropping of these crops were identified.

2.5. Strengthening Research Capabilities of National Agricultural Systems.

2.5.1. Analysis of the Current Research Manpower Situation in Food Grains.

Shortage of qualified research manpower is one of the major constraints to strengthening food grain research in SAFGRAD member countries. Had long-term training for scientists been one of the activities of SAFGRAD II, it would have made a major impact on the development of research manpower within the respective networks. The current research staff and the future research manpower needs (1990-2000) for the four crop commodity networks are indicated in Fig. 5. The qualifications of researchers and the propositions of their time devoted to research (i.e., whether full-time or part-time) on the crops of the networks vary considerably. For example, close to 75 researchers *are engaged in the improvement of maize in the 17 countries of West and Central Africa. Twenty of the scientists have the Ph.D. degree or equivalent qualifications; about an equal number* *possess the M.Sc degree (or its equivalent) while the rest were trained only up to the first degree level. About 40 of the relatively well qualified researchers are based at the six Lead Centres ( ). Close to 50% of the total number of scientists are working full time on maize improvement; the rest devote 10-60% of their time on maize improvement research.*

The research qualifications of cowpea research scientists and the proportion of their time devoted to cowpea research have been crucial constraints to the cowpea improvement effort. Out of 65 researchers in the 17 countries that participate in the Cowpea Network, hardly 30% are engaged in full time cowpea research. Furthermore, about 65% are junior scientists who still require advanced, graduate-level training. Most of the qualified and experienced researchers are based at the six Lead Centres.

The EARSAM Network member countries have close to 74 research workers (25% with Ph.D. and 35% with M.Sc degrees) engaged in sorghum and millet research in East and Southern Africa.

The research manpower situation of the West and Central Africa Sorghum Network did not improve much during the last decade. In the 17 member countries of the sub-region, there are about 70 researchers. More than 50% of these work part-time on sorghum research although they are also engaged on millet improvement. About 60% of the researchers are relatively junior scientists who could benefit from post-graduate level training. Only 15 of the researchers have the Ph.D. degree or its equivalent. Furthermore, 25% of the qualified researchers are based at the five Lead Centres.

2.5.2. Improvement of Research Skills and Exchange of Technical Information.

(i) Short-term Training.

Training in respect of the crop commodity networks has focused on improvement of research skills of technicians and

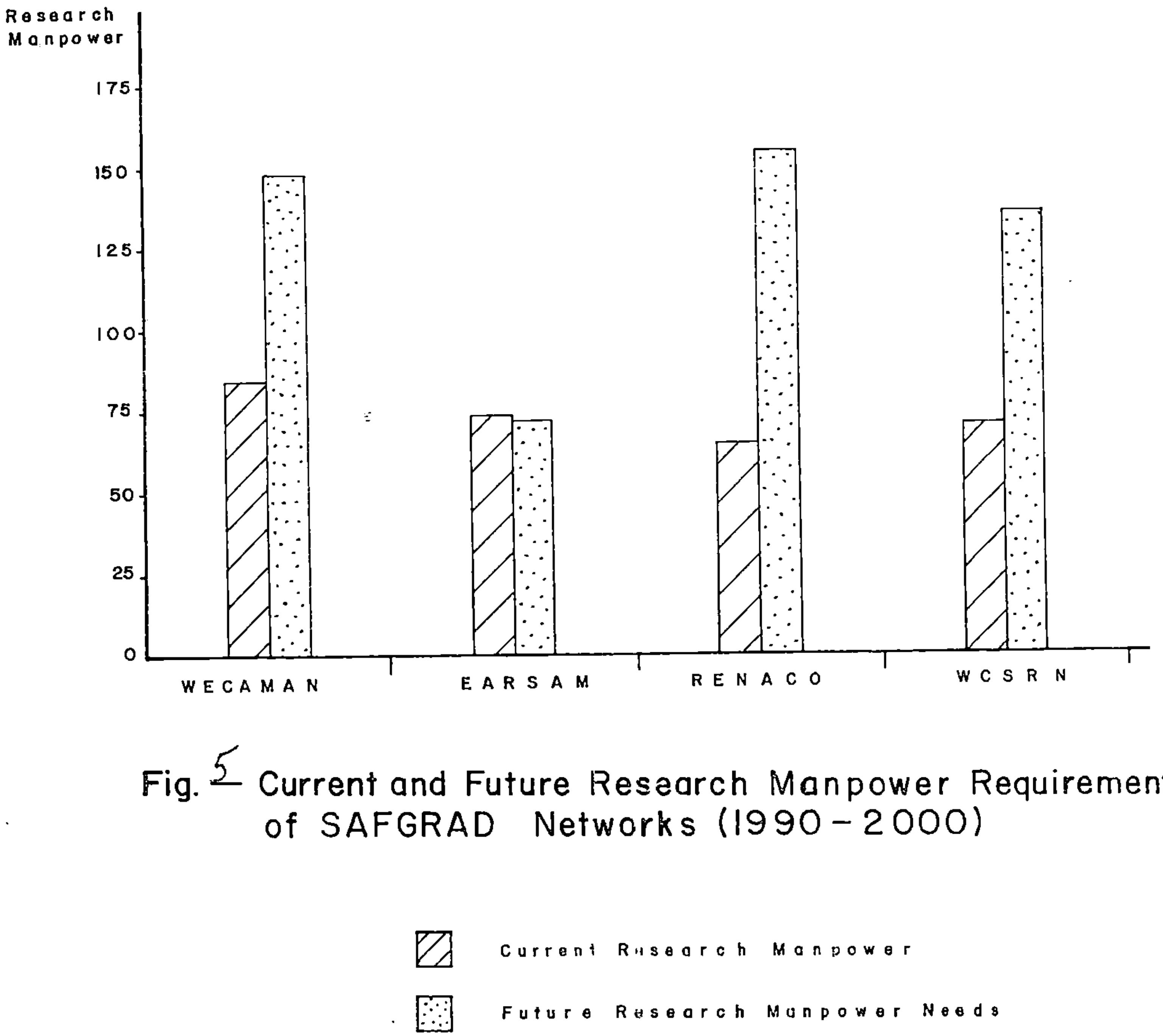


Fig. 5 Current and Future Research Manpower Requirements of SAFGRAD Networks (1990-2000)

scientists engaged in research on the crops in SAFGRAD member countries. During SAFGRAD II, short-term trainings/seminars (from a few days to five months) were offered, based on needs of the different national programmes. As summarized in Table 8, the topics covered included: research methodology, analysis of the state of the art of food grain research, agronomic research, Striga research and control, pest and disease control, techniques for technology transfer and adoption, etc.

The emphasis placed on training varied from one network to another (Table 8). For example, the West and Central Africa Maize Research Network organized a 5-month in-service training course covering breeding techniques, experimental design and field trial management, data collection, processing, and seed production. Feedback information indicated that such training had made a great impact in improving the execution of field experiments. However, due to financial constraints, only 15 participants from different countries benefitted from that particular course. The EARSAM Network organized a seed production technology workshop as well as short-term entomology and pathology courses that benefitted close to 80 participants. On the other hand, the West and Central Africa Sorghum Network organized a Striga control training and two agronomic seminars that benefitted 26 participants from different member countries. RENACO, the Cowpea Network, concentrated on special research seminars to facilitate exchange of research methodology and improvement of research skills of about 50 cowpea scientists.

(ii) Multidisciplinary, Scientific Monitoring Tours.

A vital ingredient of any effective agricultural research system is the need for constant monitoring and evaluation of on-going projects.

In addition to providing on-the-spot assistance to weak NARS and acquainting participants with problems and constraints faced by collaborating institutions, an important additional usefulness of the group monitoring and evaluation tours is that they

Table 8. SAFGRAD II Training and Seminar Activities (1987-1991).

Type of training/Seminar	Executing Network	Year	Number and country of participants
1. Training of maize technicians in research skills. Five-month residence practical training on field plot techniques, variety maintenance, seed multiplication, statistical analysys, data interpretation and report writing. Training held at IITA/SAFGRAD programme based in Ouagadougou, Burkina Faso.	WECAMAN	1988 1989 1990	6 (Benin, Burkina Faso, Central Africa Republic, Chad, Guinea, Mali). 3 (Chad, Ghana and Guinea Bissau). 6 (Benin, Burkina Faso, Cameroon, The Gambia, Mali and Togo).
2. Striga control training on research methodology, screening and control. For sorghum researchers from West and Eastern Africa in Ouagadougou, Burkina Faso.	WECASORN	1987	12 (Burkina Faso, Cameroon, The Gambia, Ghana, Ghana, Kenya, Mali, Niger, Nigeria, Sudan, Togo and Uganda).
3. Training workshop on agronomic research. Topics included soil fertility, principles of on-farm research, Striga control and integration of animal production. Held at ICRISAT West Africa Sorghum Improvement Programme, Mali.	WECASORN	1989	9 (Côte d'Ivoire, The Gambia, Ghana, Guinea B., Mauritania, Niger, Nigeria, Senegal and Sierra Leone).
4. State of cowpea research in semi-arid West and Central Africa. The seminar facilitated interaction among cowpea Lead Centre scientists in breeding, agronomy, entomology and pathology. Held at IITA, Ibadan, Nigeria.	RENACO	1988	12 (Burkina Faso, Cameroon, Ghana, Niger, Nigeria and Senegal).
5. Seminar on research relevance and appropriate technology development, Kamboinse Agricultural Experiment Station, Ouagadougou, Burkina Faso.	RENACO	1989	10 (Benin, Chad, Côte d'Ivoire, Guinea Bissau, Guinea Conakry, Mali, Niger).
6. Seed production technology course for technicians.	EARSAM	1987	35 (Burundi, Ethiopia, Kenya, Somalia, Sudan, Rwanda, Tanzania and Uganda; Other participants were from private companies).
7. Entomology short course for field technicians to improve research skills in entomological research, control of common insect pests of sorghum such as stemborers, shootfly, headbugs, midge, storage insects, etc.	EARSAM	1989	17 (Burundi, Ethiopia, Kenya, Rwanda, Somalia, Sudan and Uganda).
8. Short course on sorghum diseases-mainly to upgrade skills in the recognition and identification of diseases, measuring disease incidence, severity, and control.	EARSAM	1989	12 (Burundi, Kenya, Rwanda, Somalia, Sudan, Tanzania and Uganda).
9. Research agronomy seminar to improve sorghum, maize and cowpea cropping systems, soil fertility and management.	INTER-NETWORK	1991	20 (Benin, Burkina Faso, Cameroon, Cent. Africa Rep. Chad, Ghana, Mali, Nigeria, Niger, Guinea Conakry, Mauritania and Senegal).

facilitate the assessment of the contribution of technologies generated by Lead NARS Centres and participating IARCs. The tours also facilitate evaluation of diffusion of technologies tested in regional trials.

These scientific tours were organized in alternate years during the crop growing seasons. The objectives of these tours have been to:

i) familiarize national programme scientists with the research efforts in various national programmes, thereby enabling them to appreciate the commonality of agricultural production constraints.

ii) enable national programme scientists to visit trials in other national programmes.

iii) facilitate the exchange of research experiences and to establish linkages between relatively senior and young researchers.

iv) expose young researchers to the multidisciplinary research approach during group evaluation of the performance of elite germplasm included the regional trials.

v) facilitate interaction among NARS scientists and research policy makers, on the one hand, and between IARCs and national programme researchers, on the other.

Each network organized a monitoring tour every two years (Table 9). As indicated in Table 9, about 100 NARS scientists have participated in the scientific monitoring tours. In general, Lead NARS Centres' research activities were visited even though the researchers were from both relatively weak and strong national programmes. In West and Central Africa, the research activities of the national programmes of Burkina Faso, Cameroon, Ghana, and Nigeria were frequently visited. The EARSAM Network *monitoring tours visited sorghum and millet research efforts of Sudan, Kenya and Ethiopia.*

Table 9. SAFGRAD II Scientific Monitoring Tours.

Network	Year	Date	Number of participants	Countries visited
WECASORN (Sorghum West Africa)	1986	23 Sept-16 Oct.	12	Burkina Faso, Cameroon, Gambia, Nigeria and Senegal
	1987	30 Sept-03 Oct.	12	Burkina Faso.
	1989	09-18 October	8	Mali, Burkina Faso and Niger.
RENACO (Cowpea Network)	1988	05-21 September	8	Burkina Faso, Niger and Nigeria.
	1990	27 Aug-14 Sept.	10	Burkina Faso, Niger and Nigeria.
WECAMAN (Maize Network)	1988	12-20 September	8	Burkina Faso and Ghana.
	1990	08-22 September	11	Cameroon and Nigeria.
EARSAM (Sorghum and Millet Network Eastern Africa)	1989	22 Oct-01 Nov.	15	Sudan.
	1990	17-20 October	13	Kenya and Ethiopia.
		28 Oct-09 Nov.-	7	Ethiopia and Sudan.

(iii) Workshops and Conferences

The exchange and dissemination of research results and technologies are some of the positive attributes inherent in networking. The hosting of biennial workshops/conferences by the various networks enabled NARS and IARC scientists not only to discuss the research findings of the preceding two years, but also to scrutinize programmes and activities scheduled for implementation during the subsequent two years.

Conferences, workshops, symposia, and related technical meetings organized by SAFGRAD provided opportunities for more than 800 national programme scientists to exchange technical information, share experiences, and forge partnership not only among themselves, but among their respective institutions. As summarized in ~~Annex 8~~ Table 10, ten technical networkshops were held by the respective networks between 1986-1991. Although the themes of these technical workshops varied, the focus of the first workshop was to identify constraints to food grain production as well as to prioritize researchable issues. Subsequent workshops of the respective networks, reviewed the state-of-the-art of food grain improvement and production through presentation and discussion of technical papers and decided on germplasm and other technologies to be included in the regional trials.

The eight general conferences (Annex 8) organized during SAFGRAD II, covered a wide range of subjects. Two of the conferences on policy matters were held by National Agricultural Research Directors in 1987 and 1989 and were attended by 18 and 22 SAFGRAD member countries, respectively.

One of the major thrusts of SAFGRAD has been strengthening of the technology transfer process of NARS. To this effect, four on-farm research workshops were held to address issues related to appropriate technology, sustainable agriculture, and methodologies for on-farm verification and validation.

SAFGRAD II activities were climaxed by the Inter-Network Conference on "Food Grain Research and Production in Semi-arid Africa" that took place from 7-14 March, 1991, in Niamey, Niger. This major conference was attended by 160 NARS scientists, representing 22 SAFGRAD member countries, as well as scientists from several international agricultural research centres and regional agencies. More than 100 technical papers were presented on various aspects of research and production of the mandated food grain crops of SAFGRAD. The need for a coordinated research effort to address basic crop production constraints such as Striga and drought was stressed. The importance of mixed cropping in the farming systems of the sub-region and the need for multidisciplinary approach to cropping systems research were emphasized.

(iv) Enhancing Subject Matter Technical Consultancy Services among NARS.

Another vital activity of SAFGRAD has been to tap qualified, technical manpower resources of NARS to provide technical advisory/consultancy services at various levels of networking activities in SAFGRAD member countries. Most countries of sub-Saharan Africa are often confronted with similar technical and policy problems which impede agricultural production. The premise is that the policy measures and technologies employed to resolve problems of agricultural production in one country could be relevant to other countries. The SAFGRAD Network scheme has brought to the forefront highly qualified African researchers, managers and policy makers who have provided technical consultancy services in their areas of professional competence. For example, during SAFGRAD phase II, at the level of the SCO, close to 15 qualified African experts were contracted to provide technical consultancy services (totalling more than 300 man-days) to SAFGRAD Project activities in 12 member countries (Annex 9).

In order to promote interactions among scientists and to facilitate the exchange of experiences and technologies as well as to provide technical assistance to the Technology Adapting

Table 10 ~~ANNEX 8~~. General Conferences and Symposia organized during SAFGRAD II.

	Title of Conference	Venue	Year	Conference Main Theme	No. of participants	No. of countries represented.
i)	First Conference on NARS Directors.	Ouagadougou, BURKINA FASO	1987	Establishment of network policies and operational framework.	24	18
ii)	On-farm Research Workshop.	Maroua, CAMEROON	1987	Technology transfer and adoption.	69	19
iii)	Second Conference of NARS Directors.	Ouagadougou, BURKINA FASO	1989	Policy guidance and network management issues.	28	22
iv)	Farming Systems Research Workshop.	Ouagadougou, BURKINA FASO	1989	Appropriate technology and sustainable agriculture.	30	09
v)	Farming Systems Research Symposium.	Accra, GHANA	1989	Contribution of FSR.	120	16
vi)	Agronomic Research Planning Workshop.	Ouagadougou, BURKINA FASO	1990	On-farm research verification trials.	20	10
vii)	Inter-Network Conference.	Niamey, NIGER	1991	Assessment of network experience in strengthening NARS to document research progress, identify research gaps, and priorities.	152	22
viii)	Joint Steering Committee Meeting of SAFGRAD Networks.	Ouagadougou, BURKINA FASO	1991	Impact assessment study of SAFGRAD Networks.	35	12
WAFSRN/RESPAO (Farming Systems Research Network)		Ouagadougou, BURKINA FASO	1988	Workshop on national FSR in West Africa.	30	16
		Accra, GHANA	1989	FSR Symposium. Contribution of FSR to the development of improved technologies for different agroecological zones in West Africa.	120	17
ix.)	Maize and Cowpea Collaborative Research Networks Workshop	Ouagadougou, Burkina Faso	1987	Improvement of Maize and Cowpea	30	17
x)	Regional Sorghum and Millet Workshop	Mogadisho, Somalia	1988	Sorghum and Millet Improvement in Eastern Africa	55	12
xi	West and Central Africa Sorghum Research Network Workshops	Maroua, Cameroon	1988	Sorghum Improvement in West and Central Africa	45 25 70	15

(PTO)

55+70+50
170

(27)

xii) Regional Sorghum and Millet Improvement Workshop	Bujumbura, Burundi	80	12
xiii) Maize and Cowpea research Network Workshops	Lome, Togo,	80	16

93
78
152
185
130
145
783

NARS, WECAMAN, RENACO and WECASORN engaged the services of 10 senior NARS scientists (including members of respective Steering Committees) to assist in programme reviews and provide subject-matter technical services (about 120 man-days) to the weaker national programmes.

Since 1988, the Maize Network has facilitated visits (involving 70 man-days) by 11 qualified researchers to assist in various aspect of maize research in 10 countries (namely, Benin, Cape Verde, Central African Republic, Chad, Guinea Bissau, The Gambia, Ghana, Guinea Bissau, Mali, Senegal and Togo). Similarly, since 1990, the Cowpea Network has facilitated six missions by some members of its Steering Committee to provide 30 man-days of subject-matter technical assistance to the national programmes of Cameroon, Cape Verde, The Gambia, Chad, Ghana, Niger and Mauritania.

The Sorghum Network (WECASORN) also provided three missions comprising some members of its Steering Committee to provide technical consultancy services (20 man-days) to the national sorghum research programmes of Benin, The Gambia, Ghana, and Senegal (Annex 10).

III. STRENGTHENING NARS SCIENTIFIC AND RESEARCH MANAGEMENT LEADERSHIPS

Prior to realization of SAFGRAD II, researchers were working in isolation and duplication of research efforts was common. Through the collaborative networks, NARS were better organized to promote research of mutual interest and develop African scientific leadership.

The SCO has played a major role in enhancing the emergence of NARS scientific leadership and research management as discussed below.

(50)

3.1. Scientific Leadership in the National Programmes.

The networking entities instituted in SAFGRAD II have achieved the following:

a) Developed research plans of the networks.

b) Assigned research responsibilities to lead NARS based on availability of physical facilities, qualified research staff, and optimum environmental conditions to screen varieties or elite germplasm for resistance to particular biotic and abiotic stresses. Lead NARS have assumed research leadership which is being developed within future satelite "centres of research excellence".

c) Assessed the research capacities and priorities of NARS before providing technical, logistic and financial support to weaker (technology - adapting) NARS, in order to enhance their full participation in collaborative research networks.

The Lead Centres of respective networks assumed regional research responsibilities in their areas of comparative advantage and competence and subsequently implemented 25 to 30 collaborative research projects. These "centres" not only shared their technologies with other NARS but also provided leadership for the respective networks. Thus NARS scientists and research managers not only determined research priorities of their respective national programmes, but also pooled scientific talents and resources together to solve food production problems of regional importance.

As indicated earlier in Tables 1,2 and 3, the West and Central Africa Maize, Sorghum and Cowpea Networks assigned scientific leadership roles to 43, 35 and 37 qualified NARS researchers, respectively. The EARSAM Network gave similar responsibilities to 45 leading scientists to execute its collaborative research projects.

(51)

3.2. Development of the SAFGRAD Strategic Plan.

The emergence of NARS scientific leadership and the prioritization of common research needs of member countries convinced NARS to develop both medium and long-term strategic plans.

On the basis of the technical progress attained and achievements recorded by the respective networks, and following the favourable mid-term evaluation of SAFGRAD II, the SCO proceeded to initiate the drawing up of a "Strategic Plan" aimed at consolidating and building on the gains of SAFGRAD I. Consequently, the SCO facilitated the broad and intensive participation of NARS in the development of the Strategic Plan primarily through the following process:

a) *Initially, constraints, research priorities and resources of NARS were collected at national level.*

b) *Key elements of the Strategic Plan were discussed at the February 1989 Conference of the Council of NARD. The various networking entities (Steering Committees, SCO, Oversight Committee, IARCs) and the relevant NARS institutions were urged to have concerted inputs in the development and evolution of the Plan.*

c) *A meeting of Network Coordinators was held from 14-15 June, 1989 at which issues related to medium-and long-term strategic plans were exhaustively and elaborately reviewed and discussed.*

d) *Thereafter, numerous planning sessions were activated by the SCO, involving the various Network Steering Committees and notably:*

   i) *The EARSAM Network held a planning meeting from 23 October to 1 November, 1989 in Wad Medani, Sudan at which, among other activities, the Strategic Plan was discussed.*

ii) *The Steering Committees of the Cowpea and Maize Networks held a joint meeting from 6-10 November, 1989, in Ouagadougou, Burkina Faso, at which their respective medium and long-term plans were developed.*

iii) *The West and Central Africa Sorghum Network held its meeting from 14-17 November, 1989, also in Ouagadougou, at which the Steering Committee elaborated on the future plans and activities of the Network.*

iv) *Following these various planning sessions by the network Steering Committees, the SCO put in place a technical Working Group comprising representatives of the Council of NARD, Oversight Committee, and network Steering Committees, as well as all Network Coordinators. The Working Group met in Ouagadougou from 27 November to 1 December, 1989. In order to facilitate the work of the Group, the SCO prepared working documents based on the outcome of the planning sessions by the various Steering Committees. The Working Group was organized in five sub-groups covering each of the networks as well as the management entity (SCO), with one intensive plenary session at the end.*

v) *A draft of the Strategic Plan emanating from the deliberations of the Working Group was subsequently tabled and exhaustively discussed at the February 1990 meeting of the Oversight Committee. Suggestions of this committee were incorporated to improve the contents of the Strategic Plan.*

3.3. Transferring Network Coordination and Leadership to NARS.

The global objective of SAFGRAD II has been to assist member countries organize collaborative research networks in order to improve the production and productivity of food grains as well as to transfer research leadership to NARS. To attain these goals, the IARCs and SCO have jointly through training, technical research, logistic, and political support, facilitated leadership development among NARS scientists.

The achievements recorded under SAFGRAD II, especially in terms of strengthening national research systems and facilitating the emergence of scientific and management leadership, were the basis for the decision to transfer network leadership and management to NARS. This issue was debated at all levels of network entities. Arguments that warrant caution not to rush the transfer are based on the reality that, despite the above achievements, most NARS lack qualified and experienced researchers and resources, even to sustain an active programme of their own. Moreover, Lead NARS Centres, in order to serve as technological base for network coordination, also require substantial improvement in managerial capability and institutional flexibility. On the other hand, NARS already have excercised influence in the direction and management of the programmes through the activities of network entities. For example, Lead NARS have increasingly become responsible for implementing research through collaborative projects and regional trials.

The rationale for the transfer of network leadership to NARS should be perceived:

i) To bring NARS, the beneficiaries to the forefront as "main actors" and the driving force of the networks. This has, increasingly, enabled NARS to collectively identify their research needs and priorities and to formulate their own network programmes.

(54)

ii) *To evolve the setting of NARS research priroties from grass roots ("bottom-up") so that research programmes be more client-oriented and demand-driven.*

iii) *To enhance NARS scientific and research management leadership in their sub-region, and to concurrently optimize the utilisation of technical support and services provided by relevant IARCs and indigenous regional organizations and donors.*

iv) *Through SAFGRAD II, NARS have increasingly exercised leadership in network research and management as summarized in Annex 3.*

The "internal network appraisal" team (made up of high-level NARS and IARC scientists), under the supervision of the Oversight Committee, suggested the appointment of coordinators from the NARS as first essential step to transfer network leadership. The network appraisal team summarized the debate on this issue as follows:

a) "Among the arguments made against the appointment of coordinators from the NARS were:

i) *The inadequacy of qualified staff within the NARS and the possible collapse of NARS resulting from the loss of scientists to the position of network coordinators.*

ii) *The greater trust of IARCs by donors and the apprehension that donor support may be lost if NARS took hold of network management.*

Having spoken with the NARS in considerable detail about this issue, the network appraisal team is convinced that there are enough competent scientists in some NARS whose appointments as coordinators will do credit to the networks without adversely affecting the NARS from which they come. Regarding the second argument, it can only be observed that over the years, the SCO has managed its affairs in such a way that it has received the *commendation of various external evaluation teams and therefore should attract the confidence of donors".*

b) "Some of the arguments adduced in favour of the transfer of network management to NARS were:

i) Appointment of coordinators from NARS will better guarantee continuity of performance as IARCs support for the coordinators position is unlikely to be permanent.

ii) Appointment of coordinator from NARS will not only reinforce the apparent confidence of NARS in their ability to manage the networks but will also fulfil the goal set for SAFGRAD.

iii) Resources of NARS may be upgraded particularly if the coordinators are located in the NARS institutions.

iv) The rapport between NARS and the coordinator will be enhanced since the latter comes from the NARS".

"The overwhelming view of the NARS and some IARC representatives was that management of the networks should be transferred to NARS now". Conditions for the smooth transfer of network leadership were also proposed ( ).

For rapid inflow of technology, viable linkages between IARCs through the networks need to be maintained as depicted in Fig. 6, which indicates the need for the IARCs to appoint Network Research Officers (scientists) to assist NARS network coordinators in facilitating the flow of germplasm, coordinate collaborative research projects and evaluation of regional trials, in order to minimize duplication of efforts. The Network Research Officers, to be based at IARCs, would also expected to coordinate training, seminar and workshop activities of the IARCs with those of SAFGRAD networks.

The eight considerations outlined in Table 10, reflect the stage of network leadership assumed by NARS in research coordination and management. Equally important, the weak areas of network programmes that need to be strengthened have been identified. These include: strengthening NARS technological base for network coordination, training and infrastructural support required to establish sound financial and research management systems, and long-term (higher degree-related) training for research scientists with a view to improving the number of fully qualified researchers in various aspects of food grain research at national and regional levels.

IV. PROBLEMS ENCOUNTERED IN ACHIEVING SAFGRAD II PROJECT OBJECTIVES.

A) At the SAFGRAD Secretariat Level.

The SAFGRAD Coordination Office as the hub of network activities has been handicapped in timely and efficiently disseminating technological information. Some of the problems encountered were:

1) Shortage of essential technical support staff and resources.

This included:

i) Communications officer with broad experience in editing and agricultural journalism to enhance timely publication of reports, newsletter, technical documents, and to facilitate the exchange of technical information and diffusion of technology between and among NARS.

ii) Planning, monitoring and evaluation officer to routinely follow up the utilization of resources (funds, manpower, etc.) vis-à-vis project implementation. To also assess impacts of agricultural research on development, and based on data feedback from field level (in different NARS), to reorient network programmes according to short- and long-term research needs of NARS.

iii) A second translator/editor to simultaneously publish and disseminate technical information in French and English.

iv) Establishment of a desk-top publishing outfit to facilitate the timely publication of relevant technical documents (the newsletter, workshop and seminar proceedings, etc).

v) A professional documentalist to systematically operate a data base on NARS and the Networks.

2) Lack of effective Coordination between networks (CORAF/SAFGRAD) and among institutions (IARCS, SAF-GRAD, INSAH, etc.).

NARS' capacity building efforts need to be coordinated among institutions since they all have common objectives. Because of the lack of mechanisms to enhance coherence and complementarity among the above regional institutions' and IARCs, NARS are often overburdened with several regional trials, nurseries, etc. This often affects their research output since their scientists frequently travel away to attend seminars, workshops and other activities concurrently organized by the various institutions.

c) Insufficient inter-network communication and integration of programmes.

Networking is a mobile activity. It involves extensive travelling to attend seminars, workshops and steering committee meetings, and to participate in programme reviews of NARS and IARCs. Inter-network coordination endeavours are curcial to resolve the following problems:

- *Duplication of efforts and overlapping activities, especially avoiding similar sets of field trials. Investment in such duplication could be better used to support other essential areas of research.*

- *Conducting multidicisplinary research between or among networks could lead to sharing of technology or research equipments, etc.*

d) Long-term Committment for Institutional Development.

It is evident that national governments have yet to improve *their commitment to agricultural research. It has been observed that only about ten percent of resources are allocated to agricultural development in most SAFGRAD countries. Furthermore, government and donor support (long-term) is crucial to improve the research environment (i.e. establishing innovative research carriers), improving living and research conditions, providing encouragement through adequate compensation to scientists, based on creativity and output, etc, in order to increase productivity. In addition, transfer of technology to farmers, depends on supportive government policies. Strengthening of NARS, including development of scientific leadership, is a long-term undertaking which requires donor understanding and appreciation for long-term support.*

e) Sustainability of networks.

This requires long-term planning and commitment of financial and research resources by NARS institutions, respective governments and donors. Implicit in the concept of SAFGRAD II has been the gradual shift of the management and control of networks to participating countries.

The sustainability of networks will depend largely on the extent to which network programmes have been responsive to the research and development needs of member countries as well as the extent to which network activities are entrenched in the national research systems. Sustainability of networks also raises several concerns since the attainment of this goal would ultimately depend on NARS leadership development in scientific research and management as well as on a greater spirit of regional cooperation.

4.2. At Network Level.

a) There is need to improve the scientific pool of qualified researchers in various fields of agricultural research and development.

Many countries have not yet attained the minimum level *of qualified researchers and technicians to effectively provide technical support for agricultural development. Lack of resources for training, particularly at M.Sc. and Ph.D. levels has been the major constraint in improving the pool of qualified research man power in the sub-region.*

b) *There is need to improve the quality of data of regional trials as well as that of the collaborative research project activities.*

In general, conducting of regional trials also requires some improvement. The magnitude of the coefficient of variation can be reduced, unless crop failures prevail due to extreme environmental stress. Due to improvement of research skills, it is gratifying to note, that the quality and reporting of data of network trials have improved substantially during the last three years.

In the past, late return of data by some cooperators constrained and delayed the combined analysis of the performance of varieties across locations. Researchers should be encouraged and urged to send results of regional trials in time.

From networks' strategic point of view, lead NARS centres are expected to be the major source of germplasm for the cooperating technology adapting NARS and for regional trials. The development of such capabilities requires serious commitment from the participating NARS of member countries, IARCs, donors, and regional organizations.

Although the progress of collaborative research projects is reviewed by the Steering Committees of the respective networks, few of the project leaders have submitted technical reports.

c) *There is need to improve research infrastructure and environment of national systems. In general, NARS are starved for resources not only for recurrent costs but also for improving research infrastructures such as, cold room facilities to store essential germplasm, basic agronomic laboratory facilities, etc. Furthermore, most NARS lack conducive research career structures which are very crucial to motivate scientists to increase their productivity.*

A N N E X E S

Annex 1. Total sorghum production trends in SAFGRAD member countries in West and Central Africa.

Country	Area Harvested ('000)				Yield (kg/ha)				Production ('000 MT)			
	1979/81	1987	1988	1989	1979/81	1987	1988	1989	1979/81	1987	1988	1989
Benin	90	118	133	139	650	806	733	786	59	95	97	110
Burkina Faso	1051	1176	1295	1362	589	721	779	728	620	848	1009	991
Cameroon	374	250F	253	270F	805	900	909	889	301	225F	230F	240F
Cape Verde	-	-	-	-	-	-	-	-	-	-	-	-
Centr. Afr. Rep.	57	47*	40*	45F	673	828	1225	1111	39	39*	49*	50F
Chad	414	500	530	500F	570	586	623	578	227	293	330*	289*
Côte d'Ivoire	40	37	38	40F	600	622	632	575	24	23	24	23*
Gambia	6	9	10	14*	795	778	700	1071	5	7	7*	15*
Ghana	223	272	226	284	639	758	786	863	140	206	178	245
Guinea Conakry	20	24F	24F	24*	1250	1417	1417	1417	25	34F	34F	34*
Guinea Bissau	28	60F	60F	60F	637	617	583	633	18	37	35	38*
Mali	434	491	624F	600F	785	1045	1139	1193	341	513	711*	716*
Mauritania	102	116	164	149F	272	776	665	517	28	90F	109	77*
Niger	822	1100F	1470	1566F	432	333	381	289	347	366	560	452
Nigeria	3050	3182	4247	4200F	1092	1851	1165	1092	3341	5890	4948	4587
Senegal	130	128	130	127*	996	869	846	866	131	111	110*	110*
Sierra Leone	7	8 F	8F	8F	1571	2250	2375	2375	11	18F	19F	19F
Togo	122	136	181	200	715	717	658	811	87	98	119	162

Source: FAO Production yearbook Vol. 43, 1989
F - FAO Estimate
* = Preliminary data

Annex 2. Total millet production trends in SAFGRAD member countries in West and Central Africa.

Country	Area Harvested ('000)					Yield (kg/ha)				Production ('000 MT)			
	1979/81		1987	1988	1989	1979/81	1987	1988	1989	1979/81	1987	1988	1989
	M	S+M	M	M	M	M	M	M	M	M	M	M	M
Benin	13	103	31	35	31F	504	641	635	677	7	20	23	21*
Burkina Faso	803	1957	1168	1277	1278	486	541	640	508	390	632	817	649
Cameroon	130	503	100F	110F	110F	753	750	727	909	98	75F	80F	100F
Cape Verde	-	-	-	-	-	-	-	-	-	-	-	-	-
Centr. Afr. Rep.	16	73	10*	10*	13F	680	976	971	1154	11	10*	10*	15F
Chad	360	790	450	460	400*	525	500	798	642	182	225	367*	257*
Côte d'Ivoire	64	104	68	70	72F	582	603	600	549	37	41	42	41*
Gambia	28	28	44	60*	59*	916	1136	800	949	26	50	48*	56*
Ghana	182	405	235	228	244	648	737	844	738	117	173	192	180
Guinea Conakry	35	41	40F	40F	40*	1429	1500	1500	1500	50	60F	60F	60*
Guinea Bissau	16	44	30F	30F	30F	600	900	833	833	10	27	25	25F
Mali	643	1077	782	1000F	980F	716	887	965	880	461	694	965*	862*
Mauritania	12	117	20	13	15F	290	350	538	533	3	7F	7	8*
Niger	3011	3811	3000F	3526	3385F	435	340	501	382	1311	1020	1766	1293
Nigeria	2836	5929	3705	3874	3400F	857	1187	985	1029	2420	4397	3816	3500F
Senegal	932	1062	946	898	977*	587	729	539	687	555	690	484*	671*
Sierra Leone	9	9	15F	16F	16F	1343	1333	1375	1375	12	20F	22F	22F
Togo	121	243	128	118	120*	384	552	479	649	44	71	56	78

Source: FAO production yearbook Vol. 43, 1989
F = FAO Estimate
* = Preliminary data.

Annex 3. Total sorghum production trends in SAFGRAD member countries of Eastern Africa.

Country	Area Harvested ('000ha)				Yield (kg/ha)				Production ('000 MT)			
	1979/81	1987	1988	1989	1979/81	1987	1988	1989	1979/81	1987	1988	1989
Burundi	53	63F	77*	58*	1000	1000	1465	1514	53	63	113	88
Ethiopia	1048	900*	800*	900F	1372	1056	1205	1071	1419	950F	964*	964F
Kenya	168	138	140	146*	984	803	1029	979	160	111	144	143*
Rwanda	159	160F	170*	173F	1129	1175	1041	948	178	188	177*	164F
Somalia	478	516	570	550F	347	472	412	529	167	244	235	291
Sudan	3163	3360	5577*	3682*	731	410	793	523	2361	1379	4425*	1924*
Tanzania	713	758	514	514F	763	875	817	979	543	663	420	503
Uganda	175	185	199*	180F	1788	1550	1452	1444	312	286	289	260F

Source: FAO production yearbook Vol. 43, 1989
F = FAO Estimate
* = Preliminary data.

Annex 4. Total maize production trends in SAFGRAD member countries in West and Central Africa.

Country	Area Harvested ('000)				Yield (kg/ha)				Production ('000 MT)			
	1979/81	1987	1988	1989	1979/81	1987	1988	1989	1979/81	1987	1988	1989
Benin	407	395	486	480	711	677	884	949	289	267	430	455
Burkina Faso	123	176	277	221	880	741	819	1162	108	131	227	257
Cameroon	495	400F	408*	420*	852	1025	1029	1024	418	410F	420F	430F
Cape Verde	11	20	25F	12F	365	719	639	600	4	21	16	7*
Centr. Afr. Rep.	108	65	69	68F	372	1020	1019	1029	40	66	70	70F
Chad	32	60F	62F	35F	836	567	548	457	27	34*	34*	16*
Côte d'Ivoire	514	621	639	670*	700	700	701	672	352	435	448	450
Gambia	7	13	13F	11*	1460	1154	1231	1455	10	15	16*	16*
Ghana	390	548	540	567	982	1091	1391	1320	380	598	751	749
Guinea Conakry	87	90F	90F	94	1000	1000	800	1150	87	90F	80F	108
Guinea Bissau	13	25F	25F	25F	687	800	600	800	9	20	15*	20F
Mali	52	118	114*	125F	1221	1512	1882	1824	61	179	215*	228*
Mauritania	8	2F	11	5F	573	500	636	600	5	1	7	3*
Niger	14	5F	3	5F	708	600	1667	1600	10	3	5	8
Nigeria	443	1137	1556	1500F	1350	1193	1170	1067	599	1357	1821	1600F
Senegal	75	99	112	113*	876	1149	1097	1097	66	114	123	124*
Sierra Leone	13	18*	18*	17F	974	704	711	706	13	12*	13*	12F
Togo	147	225	267	258	1024	765	1109	950	150	172	296	245

Source: FAO Production yearbook Vol. 43, 1989
F = FAO Estimate
* = Preliminary data

Annex 5. SAFGRAD Network Steering Committee Meetings (1987-1991).

YEAR	WECAMAN		WECASORN		RENACO		EARSAM	
	Date	nO. of Participants	Date	nO. of Participants	Date	nO. of Participants	Date 1986	nO. of Participants
1987	March November	7 (4) 6 (8)	March December	4 (8) 5 (2)	March November	7 (4) 6 (8)	July	7 (6)
1988	April November	6 (7) 6 (8)	September	6 (5)	March November	5 (10) 6 (8)	July November	6 (2) 6 (2)
1989	March November	7 (8) 6 (5)	May November	6 (3) 7 (4)	March November	7 (5) 7 (6)	October	9 (6) 9 (6)
1990	March November	6 (4) 7 (5)	May December	7 (5) 7 (10)	March November	5 (4) 7 (7)	June October	8 (8) 9 (5)
1991	March November	7 (3) 6 (4)	March November	7 (8) 7 (5)	March November	6 (3) 6 (4)	September	6

Figures in parentheses indicate observers from the IARCS, SCO, INSAH and other regional research and development agencies.

Annex 6. Number of regional uniform maize variety trials requested by NARS and data recovery (1987-1991).

Country	No. of trials received					Data recovery*			
	1987	1988	1989	1990**	1991	1987	1988	1989	1990
Benin	6	10	9	6	5	0(0)	6-60)	6-67)	6(100)
Burkina Faso	4	8	7	6	6	4(100)	8(100)	7(100)	6(100)
Cameroon	2	7	8	6	6	0(0)	6(86)	8(100)	6(100)
Cape Verde	2	2	1	1	1	0(0)	0(0)	0(0)	0(0)
Cent. Afr. Rep.	4	4	4	3	4	0(0)	2(50)	2(50)	2(67)
Côte d'Ivoire	1	6	6	3	5	0(0)	0(0)	2(33)	2(67)
Gambia	4	4	4	4	4	2(50)	0(0)	4(0)	2(67)
Ghana	2	2	6	3	6	2(100)	2(100)	6(100)	2(50)
Guinea	5	4	8	4	3	5(100)	0(0)	2(25)	3(100)
Guinea Bissau	1	7	5	2	4	0(0)	0(0)	0(0)	3(75)
Mali	2	0	3	5	5	1(50)	-	3(100)	0(0)
Mauritania	0	0	2	2	2	-	-	2(100)	4(80)
Niger	1	3	3	2	3	1(100)	1(33)	2(67)	2(100)
Nigeria	3	4	3	5	6	2(67)	3(75)	3(100)	2(100)
Senegal	5	9	8	0	4	5(100)	0(0)	5(63)	4(80)
Tchad	3	3	2	4	4	0(0)	0(0)	2(100)	-
Togo	8	9	6	4	4	3(38)	6(67)	6(100)	4(100)
TOTAL	53	82	85	60	72	25(47)	34(42)	56(66)	50(83)

* Figs in parentheses represent % recovery.

** In 1990, there was an arrangement between IITA and SAFGRAD to harmonize trials (germplasm) delivery to NARS. SAFGRAD handed over late variety trials (RUVT 2) to IITA and the latter ceased to deliver early variety trials (RUVT 1).

Source: SAFGRAD II Final Report of the Maize and Cowpea Collaborative Research Networks, IITA/SAFGRAD, June, 1991.

Annex 7. Maize varieties cultivated in various countries in West and Central Africa.

Country and name of variety	Origin	Where grown	% of total maize area
BENIN			
TZB and TZB-SR	IITA	North	22
Poza Rica 7843-SR	CIMMYT-IITA	South	7
TZSR-W	IITA	North	5
TZESR-W	IITA	North	5
Pirsaback 7930-SR	CIMMYT-IITA	South	2
Massahoue	Benin	South	10
Gbade Souaton	Benin	South	10
Gbade Sou Enin	Benin	South	10
BURKINA FASO			
SR22 (=EV8322-SR)	CIMMYT-IITA	NGS	25
IRAT 171	INERA/IRAT	NGS	10
Maka	Mauritania	SS	1
IRAT 80	INERA/IRAT	NGS	1
IRAT 200	INERA/IRAT	NGS	1
FBH 1	INERA/IRAT	NGS	0.5
FBH 1	INERA/IRAT	NGS	0.5
IRAT 81	INERA/CI	NGS	0.5
KPB (=EV8330-SR)	CIMMYT-IITA	NGS	0.5
8321-18	IITA	NGS	0.5
CAPE VERDE			
Local Santiago	Cape Verde	Semi-Arid	75
Local Fogo	Cape Verde	Arid	20
Local	Cape Verde	Arid	5
CENTRAL AFRICAN REPUBLIC			
Dentado Compuesto Blanco	CIMMYT	-	-
Los Diamantes 7921	CIMMYT	-	-
Local Varieties	Cent. Afr. Rep.	-	
CHAD			
Mathan Kouri	Chad (local)	Sahel zone	
Gusau 82 TZESR-W	IITA	Lake Chad area	
CMS 8501	Cameroon		
CMS 8507	Cameroon		
Locals	Chad		
COTE D'IVOIRE			
CD	Benin	Centre	-
MTS	Côte d'Ivoire	Centre	-
CJB	Côte d'Ivoire	Country wide	-
Ferke 7929	CIMMYT	Country wide	-
Ferke 7529	CIMMYT	North	-
TZSR-Y	IITA	Centre-North	-
Ferke 7622	CIMMYT	North	-
IRAT 83	IRAT/CI	South	-
IRAT 81	IRAT/CI	North	-

Annex 7. (Cont'd-2).

Country and name of variety	Origin	Where grown	% of total maize area
NIGERIA			
TZB/TZB-SR	IITA	Across Nigeria	
TZPB/TZPB-SR	IITA	" "	
TZSR-W	IITA	" "	
TZSR-Y	IITA	" "	
8321-18	IITA	" "	
8322-13	IITA	SGS, NGS	
8329-15	IITA	Across Nigeria	
8425-8	IITA	" "	
8505-2	IITA	" "	
TZESR-W	IITA	" "	
DMR-ESRW	IITA	" "	
DMR-ESRY	IITA	Downy mildew zone	
DMR-LSRW	IITA	" "	
DMR-LSRY	IITA	" " "	
EV 8443-SR	CIMMYT-IITA		
EV 8428-SR	CIMMYT-IITA		
Western Yellow	IAR & T	South West	
SENEGAL			
JDB (Tocumen 7835)	CIMMYT	Kaolack-Casamance	40
Synthetic C	CIMMYT	" "	20
Early Thai	CIMMYT	Fleuve	10
Maka	Mauritania	Fleuve	5
Pool 16 DR	SAFGRAD	Centre	5
BDS III	Senegal	Centre	2
EVC-B	CIMMYT	Fleuve	3
EVC-J	CIMMYT	Centre-South	3
NR 52	Senegal	Nioro	1
SD 23	-	-	-
KD 32	-	-	-
VG 41	-	-	-
TB 56	-	-	-
VG 30	-	-	-
Across 7728	CIMMYT	-	-
ZM 10	Senegal	Casamance	5
TOGO			
Ikenne 8149-SR	CIMMYT-IITA		6
EV 8443-SR	CIMMYT-IITA		6
NH1	IRAT		3
Locals	Togo		85

*SGS = Southern Guinea Savanna; NGS = Northern Guinea Savanna;
SS = Sudan Savanna.

Source ( )

Annex 8

~~Table 10~~. Considerations for Transferring Network Leadership to NARS.

Activities		Remarks on current state of leadership assumed by NARS.
a) Policy guidance and management	i)	The biennal conference of NARD addressed research issues, network operation problems and technology transfer, etc.
	ii)	The OC and SC monitored the implementation of network programmes. Internal appraisal of networks was carried out.
b) Technical leadership	i)	Increasingly, NARS have assumed regional research responsibilities by implementing collaborative projects.
	ii)	But more resource support for research and training is needed to substantially improve NARS technology base for network support.
	iii)	There are some NARS scientists that could provide technical subject-matter assistance to NARS in other countries. This activity was facilitated through SC, SCO and OC.
c) Priority setting of research, development of annual network programmes, and development of medium and long-term plans.	i)	As summarized in Fig. 2, the networks through their respectives SC have effectively played this role.
	ii)	Need to further elaborate short-term targets and long-term objectives.
	iii)	Through the catalytic role of SCO, the SC, OC and NARD were able to develop the networks strategic plan.
d) Operational leadership.	i)	The coordination, supervision and implementation of network programmes was followed by SC and OC in addition to the IARCs' Coordinators and SCO.
	ii)	NARS need to develop efficient research and sound financial management systems.
	iii)	NARS may need to have their own coordinators for monitoring regional trials, collaborative projects, analysis and interpretation of data. There are some NARS scientists who have the technical, organizational, and conceptual skills to perform as coordinators, but their technological base and financial management systems need to be strengthened.
e) Organizational leadership.	i)	This requires NARS scientists to plan, implement and evaluate research. Steering Committee and Oversight Committee members have gained some experience.
	ii)	Such experience could be attained when NARS themselves serve as coordinators.
f) Conceptual leadership.	i)	Some NARS have the capacity to analyze and interpret results and to formulate plans for new direction in regional research planning.
	ii)	NARS require more experience and encouragement.
g) Financial management.	i)	Budget proposal for networks should reflect NARS' needs.
	ii)	SC - made decisions on budget allocations and disbursement of funds, for project activities of networks.
	iii)	Training to establish sound financial and research project management systems at national level is crucial particularly for identified NARS network coordinating centres as proposed elsewhere ( ).
h) Sponsoring leadership.		This requires a regional coordination entity with political umbrella and legal framework. OAU/STRC-SCO has played this critical role effectively. Thus, it has the experience, the ability and mandate to arbitrate, negotiate and manage funds for regional programmes.

ANNEX 9. NARS Consultancy Services to the SAFGRAD Project Activities.

Project Activity	Number of consultants	Year	Man-days	Countries visited
1. Impact Study of the Accelerated Crop Production (ACPO) programme	2	1987	40	Burkina Faso, Mali, Togo and Cameroon
2. Mid-term evaluation of SAFGRAD II	1 (2)	1988	45	Nigeria, Mali, Burkina Faso, Niger, Nigeria, Kenya and Côte d'Ivoire.
3. CORAF and SAFGRAD Maize Network harmonization consultation meeting	1 (3)	1989	26	Cameroon
4. Internal appraisal of the SAFGRAD Networks	5 (2)	1990	70	Niger, Mali, Burkina Faso, Kenya, Sudan and Ethiopia.
5. Evaluation of the food grain production technology verification project	1	1990	20	Ghana, Mali, Senegal, Burkina Faso and Nigeria.
6. Review of the institutional framework for SAFGRAD	2	1991	50	Nigeria, Mali, Senegal, Burkina Faso and Côte d'Ivoire.
7. Evaluation of the food grain production technology verification project	1	1991	22	Senegal, mali and Niger.
8. Editing of technical papers of Inter-Network Conference (French and English Version)	2	1991	40	Niger and Burkina Faso.
TOTAL	15	-	313	

* Figures in parentheses indicate number of consultants (including expatriates) from other organizations.

ANNEX 10. SAFGRAD Networks' Subject Matter Consultancy Services. 1987-1991.

Network	Year	Services Rendered in Countries Visited
WECAMAN (Maize)		
Coordinator	1987	Provided technical assistance to 4 countries (Burkina Faso, Central African Republic, Guinea and Mali).
1) Coordinator		
2) Steering Committee members:		
i) Dr. Esseh Yovo Mawule (Togo)	1988	Provided technical assistance to eight countries (Benin, Burkina Faso, Cent. Afr. Rep., Ghana, Guinea Conakry, Nigeria, Senegal and Togo).
ii) Mr. Hemma Idrissa (Burkina Faso)		Provided subject matter technical consultancy services to Senegal maize programme in his areas of expertise.
iii) Dr. C. Thé (Cameroon)		
iv) Dr. Badu-Apraku (Ghana)		Assisted the maize national research programme of Cape Verde and Guinea Bissau.
		Provided subject matter technical consultancy to maize national programme of Chad and Central African Republic.
1) Coordinator		
2) Steering Committee members:	1989	Provided subject matter technical consultancy services to maize research programme of The Gambia.
i) Mr. Atthiey Koffi (Côte d'Ivoire)	1989	Provided technical assistance to 8 national programmes (Benin, Burkina Faso, Cameroon, Côte d'Ivoire, The Gambia, Guinea Bissau, Chad and Togo).
ii) Dr. Charles Thé (Cameroon)		
iii) Dr. Essey Yovo Mawule (Togo)		Provided technical assistance services to national maize programme of Cape-Verde.
		Provided subject matter technical consultancy services to maize research programmes in Cent. Af. Rep. and Chad.
1) Coordinator		Provided technical consultancy services to maize research programme in Senegal.
2) Steering Committee members:		
	1990	Provided subject matter technical assistance to seven countries (Burkina Faso, Cameroon, Côte d'Ivoire, The Gambia, Guinea, Mali, Nigeria).
i) Dr. Badu-Apraku (Ghana)		
ii) Dr. Charles Thé (Cameroon)		
		Provided subject matter technical consultancy services to national maize national research programme of Togo.
		Provided subject matter technical consultancy services to national maize research programme of Benin.

Annex 10 continued

Network	Year	Services Rendered in Countries Visited
i) Mr. Abdou Ndiaye (Senegal)	1990	Provided subject matter technical consultancy services to the maize improvement programme of Mali.
ii) Dr. Charles Thé (Cameroon)	1990	Provided subject matter technical consultancy services to the maize improvement programme of Ghana.
WECASORN (Sorghum)		
Coordinator	1987	Provided technical assistance in Burkina Faso.
Coordinator	1989	Assisted the national sorghum research programme of Burkina Faso.
Steering Committee member:		
i) Dr. M. Traore (Mali) Physiologist.		Provided subject matter technical consultancy services to sorghum research programme of Senegal and The Gambia.
Coordinator	1990	Provided technical assistance to 7 national programmes (Guinea Conakry, Sierra Leone, Burkina Faso, Ghana, Nigeria, Niger and Chad).
Steering Committee members:		
i) Dr. C. Nwasike, (Nigeria) Sorghum Breeder.		Reviewed the sorghum research improvement programme in Northern Ghana (Nyankpala Research Station).
ii) Dr. Sansan Da, (Burkina Faso) Sorghum Breeder.		Provided subject matter technical consultancy to Benin sorghum research programme.
RENACO (Cowpea)		
Coordinator	1987	Assisted 8 national cowpea research programmes (Burkina Faso, Guinea, Mali, Mauritania, Niger, Nigeria, Senegal and Togo).
Coordinator	1988	Assisted 8 national cowpea research programmes (Burkina Faso, Cameroon, Cape Verde, Chad, Niger, Nigeria, Senegal and Togo).
Coordinator	1989	Assisted 9 national cowpea research programmes (Benin, Burkina Fso, Côte d'Ivoire, Ghana, Mali, Niger, Nigeria, Guinea Bissau and Togo).

Annex 10 continued

Network	Year	Services Rendered in Countries Visited
Coordinator	1990	Assisted 6 national cowpea research programmes (Burkina Faso, Mali, Niger, Nigeria, Senegal and Chad).
Steering Committee member:	1990	
i) Dr. J. Detongnon (Benin)		Provided subject matter technical consultancy to Cameroon cowpea research programme.
ii) Dr. O. Olufajo (Nigeria)		Provided subject matter technical consultancy to national programmes of Cape Verde and The Gambia.
iii) Mr. G. Ntoukam (Cameroon)		Provided subject matter technical consultancy to national programmes of Central African Republic and Chad.
Coordinator	1991	Assisted nine national cowpea research programmes (Benin, Burkina Faso, Cameroon, Ghana, Guinea, Guinea Bissau, Mali, Niger, Nigeria).
Steering Committee member:	1991	Provided subject matter technical consultancy to Ghana Cowpea Research Programme.
i) Dr. C. Dabire (Burkina Faso)		Provided subject matter technical consultancy to Niger national research programme.
ii) Dr. O. Olufajo (Nigeria)		Provided subject matter technical consultancy to national cowpea research programmes of Chad and Mauritania.
iii) Mr. G.A. Amankwa (Ghana)		
EARSAM (Sorghum and Millet Research Network in Eastern Africa)	1987-1991	The Coordinator and other ICRISAT staff provided subject matter technical consultancy services to the 8 national research programmes of the region (Burundi, Ethiopia, Kenya, Somalia, Sudan, Rwanda, Tanzania and Uganda).

Annex 11. *Striga* resistant cowpea varieties in West and Central Africa

Name of variety	Origin	Pedigree	Country in which it is resistant to *Striga*	National Programmes incorporating it into good agronomic background
Gorom Local (SUVITA-2)	Burkina Faso	A selection from a Landrace	Burkina Faso, Mali, Senegal	Burkina Faso, Mali
B301	Botswana	-	Burkina Faso, Mali, Senegal, Niger, Nigeria, Benin	Burkina Faso, Mali, Niger, Nigeria
IT82D-849	IITA-ibadan	-	Burkina Faso, Mali, Senegal, Niger, Nigeria, Benin	Burkina Faso
TN93-80	Niger	Landrace	Burkina Faso, Mali, Senegal, Niger, Nigeria	-
TN121-80	Niger	Landrace	Burkina Faso, Mali, Senegal, Niger, Nigeria	-
KVx61-1	Burkina Faso	-	Burkina Faso, Mali	Burkina Faso
IT81D-994	IITA-Ibadan	-	Burkina Faso, Nigeria	-

Source (   )

Annex 12. High yielding sorghum varieties released and in pre-released stage by NARS in Eastern Africa (1986-1990).

Countries	Released sorghum varieties	Sorghum varieties in pre-released stage
Burundi		Tegemeo Gambella
Ethiopia	Dinkmash Seredo	IS 158 x (ET3235) BC4 RS/R-20-3614-2 x IS 9379 IS 2284
Kenya	IS 76	IS 8527 IS 8293 KAT 369
Rwanda	Amasugi 5Dx160	1804 BM 33 Kigufi Nyirakabuye
Sudan		P 967033 Cross 35-5
Uganda	ET 225 HT Red 2 KX 17/B/1	3 KX 73/1

Annex 13. Millet varieties released or proposed for release by NARS in Eastern Africa (1986-1990).

Countries	Pearl Millet	Finger Millet
Ethiopia	-	FM 3 (PR)
Kenya	KAT PM 1 (PR) KAT PM 2 (PR)	KAT FM 1 (PR)
Sudan	Bristled Pop (PR)*	-
Uganda	-	P 224 (R)** P 227 (PR) U-10 (PR) Seredo x 10 (PR)

* (PR) Proposed for release
** (R) Released

1991

THE SAFGRAD COLLABORATIVE RESEARCH NETWORK, AVENUES FOR STRENGTHENING NARS IN SUB-SAHARAN AFRICA

AU-SAFGRAD

AU-SAFGRAD