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**The Maize Network for West and Central Africa
and Prospects for its Evolution**

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THE MAIZE NETWORK FOR WEST AND CENTRAL AFRICA AND PROSPECTS FOR ITS EVOLUTION

I. Phasing-out of SAFGRAD Project

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The phase I of the Semi-Arid Food Grains-Research-and-Development (SAFGRAD) Project was launched in 1977 by the Scientific, Technical and Research Commission of the Organization of African Unity (OAU/STRC) and the US Agency for International Development (USAID). The project's ultimate objective was to improve the production of maize, sorghum, millet and cowpea. The International Institute of Tropical Agriculture (IITA) accepted responsibility for undertaking regionally oriented research and training activities for maize and cowpea. The goal was to develop and promote maize and cowpea varieties, in addition to determining the cultural practices, for maize and cowpea production, that are compatible with small-scale farming systems in the semi-arid tropics (SAT). The project was under the umbrella of the OAU/STRC Coordination Office in Ouagadougou, Burkina Faso.

The SAFGRAD Phase I of the Project ended in 1986. During this phase, the resident maize research conducted by IITA/SAFGRAD in Burkina Faso resulted in the development of adapted early maturing maize varieties and management practices for soil-moisture conservation. Also, it was demonstrated during SAFGRAD I that regional commodity networks could help collaborating countries to develop and strengthen the capabilities of the national scientists and to share the technologies emanating from network efforts. The Maize Network for West and Central Africa was therefore created as one of the four collaborative networks of USAID-SAFGRAD phase II during an assembly of maize scientists from the sub-region in March, 1987. The objective of the maize network was to assist national maize programs in West and Central Africa to pool their resources together in order to tackle production problems common to countries in the sub-region through the development of appropriate technologies.

3739

SAFGRAD II activities aimed at disseminating the technologies developed in SAFGRAD I through the network and addressing problems of common concern. A council of directors of NARS provided policy guidelines while an oversight committee (OC) of six of their members followed up progress and performance of the network. A steering committee (SC) of national scientists of maize had the responsibility for the research agenda and the implementation of the network activities based on priority needs of member countries.

Based on comparative advantage, cost effectiveness, and the interests of each NARS, collaborative research projects were assigned to relatively strong national programs (Lead Centers) by the SC of each network. Scientific information and technologies emanating from the collaborative research were made available to other member countries. Network coordinators provided by IITA implemented the decisions of the steering committee and arranged for backstopping of network activities by technical programs at IITA headquarters.

During SAFGRAD II, the Maize Network underwent the mid-term and the end of project evaluations. Results of both evaluations indicated that the network had achieved most of the planned outputs with evidence suggesting that most of the project purpose had been accomplished. However, the end of project evaluation team recommended an impact assessment of the maize network since it did not have enough information to appraise the impact of the network. Consequently, USAID requested for an impact assessment study to be conducted on the maize, cowpea and sorghum networks from May, 1992 to March, 1993.

The results of the impact assessment study revealed that the Maize Network had been successful in stimulating the capacity and initiative of national scientists to solve maize production problems. Also the network had been successful in the sharing of technology between countries with national scientists taking on an increasing share of responsibility for the maize network. Several technologies had been developed and/or identified by NARS lead centers and IITA core scientists and had been adopted by several countries resulting in increased production. Moreover, several promising technologies were in the pipe-line for further testing and release. Finally,

there had been significant returns to investments in research (Sanders et al. 1993). It was recommended by the impact assessment team that greater emphasis should be placed on combined agronomic innovations and increased integration of IARC and NARS activities.

The impact assessment study identified the following as the major weaknesses of the maize network :

- i) Steering Committee of networks were made up of entirely crop researchers particularly breeders. As a result, the research programs were biased towards crop improvement thus excluding essential disciplines such as socio-economics.
- iii) There was no systematic follow-up and technical direction for the network to address some of the identified constraints.
- iii) Research grants provided to Lead NARS should have been on competitive basis.
- iv) Criteria for allocation of funds and retrieving expenditure receipts were not established.
- v) No efficient system was established to retrieve technical data from NARS.

As a result of the significant progress made by the Maize Network, USAID indicated its willingness to continue the support for the Maize Network after the termination of SAFGRAD II in March 31, 1993. IITA therefore submitted a proposal for a two-year project to USAID to enable it to continue its role of strengthening the maize research capabilities of NARS in West and Central Africa. The proposal took into consideration the recommendations of the impact assessment team and other competent persons. Since the approval process of the project was expected to take at least six months, USAID agreed to provide bridging funds to IITA to cover the period April 1 to September 30, 1993 and thus help to prevent the disruptive effects of the termination of SAFGRAD II Project.

Following the review of the maize research proposal, USAID approved funding of the maize network during a two year period.

II. Objectives and Strategy of the Maize Network for West and Central Africa

Goal

The overall goal of the project is to increase maize production and productivity of farmers in the savanna zone of West and Central Africa which would lead to increased food security and farmers' incomes.

Purpose

The purpose of the project is to continue strengthening the capacity and capability of the NARS within the network member countries to generate appropriate technologies for use by their farmers.

Objectives of the project

The project overall objective is to increase farmers productivity, production and income through the use of appropriate technologies identified or developed by the network and extended to farmers by extension services, other parastatal extension agencies, or NGOs in the respective member countries.

Project strategy

The project strategy is to bring together NARS, international centers and government authorities of the member countries concerned to establish a strong link for agricultural development. This is to enable them to exchange experience and seek ways to increase agricultural production of the peasant farmers of West and Central Africa.

III. Focus of Maize Network

A. Geographic coverage

More than 50% of the maize production in West and Central Africa is from the northern guinea savanna. Maize production in the sudan savanna

zone is also becoming increasingly important due to the availability of extra-early and early maize varieties which are playing an important role in filling the hunger gap in July/August. The savanna zone of West and Central Africa has a great potential to contribute to the agricultural development of the sub-region through the production of substantial surplus of maize for use in other agro-ecologies and for export. The network would therefore focus on the savanna zone where maize has the greatest potential and returns to investments are greatest due to optimum rainfall, adequate sunshine and few disease problems.

The maize network would encompass the coastal and sahelian countries of West and Central Africa. However, due to fund limitations it would not be possible to include all the countries in the sub-region as members of the network. Eight countries, namely, Nigeria, Cameroon, Benin, Togo, Ghana, Burkina Faso, Côte d'Ivoire, and Mali have been identified as the member countries of the maize network. The decision on network membership was based on the following criteria:

1. Importance of the crop as a staple food or its export value (please refer to appendix 1).
2. Common maize production constraints (within member countries) that influence the production, marketing, and the use of the commodity.
3. Available research infrastructure and research personnel engaged in the improvement of the crop.
4. Eco-regional approach to network research.

It is proposed that while the membership of the Steering Committee and Research Directors Committee should be limited to countries that are regular members of the network, non-member NARS of the maize network should be allowed to participate in workshops and regional trials.

B. Technical scope

The key areas of activities of the maize network would include varietal development and testing, disease and pest control through integrated pest management, agronomic/natural resource management and technology transfer.

IV. Networking

To achieve the project objectives, the following network program components are proposed:

- Collaborative research projects;
- Regionally-oriented resident research;
- Regional trials;
- Exchange of scientific information and technology
- Impact assessment;
- Human resources development.

4.1 Collaborative research projects ✓

Strategy

The strategy of optimizing the research strength and comparative advantage of strong NARS (Lead Centers) by assigning them specific research problems identified as principal constraints to maize production in West Africa would continue. It is understood that the lead centers would share germplasm and other technologies with the technology adapting NARS (weak NARS) so that they could all take advantage of gains made in other NARS as well as in the IARCs. This strategy would enable the technology-adapting countries to concentrate their efforts on adaptive research and verification of technologies to farmers' conditions.

To ensure accountability and the maximum returns from the network's research funds, it is proposed that criteria for allocation of funds for collaborative project support should be established by the NARS directors of

research. It is also proposed that the idea of competitive research grants be introduced for all collaborative project support so as to motivate NARS scientists to increase research output and to be creative. This means that all research grants should be provided on competitive basis. Two-to-three countries should be selected on competitive basis as lead centers for each collaborative research project. The criteria for the selection of lead centers could be the submission by prospective lead NARS of well conceived research proposals, availability of qualified research personnel, financial and infrastructural resources to effectively carry out specific research to alleviate food production constraints of mutual interest in the sub-region.

It is proposed that an ad hoc research committee composed of three non-member country scientists be established to review all collaborative research proposals, select the lead center for each collaborative project and allocate the research funds based on the criteria to be established by NARS directors of research. The decisions of the research committee would be subject to the approval of the steering committee. Where all collaborating countries of network are assigned responsibilities for a project, each country would submit to the research committee a project proposal. Funds would be allocated to each collaborating country based on the research proposal. Countries assigned collaborative research responsibilities should be evaluated during each planting season in order to ensure that the allocated funds are properly utilized for the designated purpose and also to monitor research progress.

The following collaborative research projects are proposed for the approval of the steering committee :

- Breeding for disease resistant, intermediate maturing maize varieties (110 days to maturity)
- Breeding for drought tolerant and disease resistant early maturing maize varieties (90-95 days to maturity)
- Breeding for disease resistant extra-early maturing maize varieties (80-85 days to maturity)
- Striga control
- Agronomic research for intermediate, early and extra-early maize varieties
- Promotion of technology transfer ↴

- Promotion of on-farm level seed production.

PROJECT I

✓ Breeding for disease resistant, intermediate maturing maize varieties.

Lead countries : 2-3 national programs to be selected on competitive basis

A) *Objectives*

- i) To develop high yielding and disease resistant maize varieties that mature in 110 days for farmers in the northern guinea savanna zone.
- ii) To make the varieties available to collaborating national programs through regional trials.

B) *Background*

The northern guinea savanna zone is a high yield potential maize belt owing to optimum rainfall and adequate sunshine. It is essential that varieties appropriate to this optimal climatic zone be developed. The incorporation of resistance to prevalent diseases such as the maize streak virus, fungal leaf diseases such as rust and curvularia leaf spot and to Striga is a prerequisite to ensuring stable and high yield. Various types of germplasm will be obtained from IITA and CIMMYT in addition to those already in the programs of the lead NARS. The lead countries implementing this project should have streak screening facilities for continuous monitoring and upgrading of the resistance levels of breeding populations and varieties.

C) *Methodology*

- i) Acquire local and exotic germplasm types identified for good adaptation and high yield potential including those with high level of resistance to prevalent diseases.

- ii) Develop appropriate breeding populations. Use recurrent selection methods to improve breeding populations and extract experimental varieties.
- iii) Incorporate resistance to streak virus and other important diseases into breeding populations. Also convert existing streak susceptible varieties of national programs to resistant forms.
- iv) Carry out preliminary yield trials to identify elite varieties that will be proposed for regional trials to collaborating NARS.

D) Expected output

- i) Availability of high yielding and disease resistant varieties that fit the guinea savanna rainfall pattern for regional trials
- ii) Intermediate maturing populations with high yield and disease resistance developed
- iii) Improved intermediate maturing varieties released and adopted by farmers

E) Indicators for monitoring impact

- i) Number of breeding populations developed
- ii) Demonstrated higher grain yield of improved varieties compared to farmers' varieties.
- iii) Number of improved varieties from the lead centers entering the regional trials

PROJECT 2

Breeding for drought tolerant and disease resistant early maturing maize varieties (90-95 days to maturity).

Lead countries: 2-3 national programs to be selected on competitive basis.

A) *Objectives*

- i) To develop maize varieties that combine earliness with drought tolerance and resistance to prevalent major diseases
- ii) To evaluate these varieties in regional trials for the selection of stable and adapted entries by collaborating national programs.

B) *Background*

The cultivation of maize varieties that mature in 90-95 days is a very attractive option for farmers in the sudan savanna and also in the northern guinea savanna under conditions where late onset or early cessation of rains has reduced the effective rainfall period. In these ecologies, incidence of drought is often a major constraint. It is therefore desirable to incorporate drought tolerance into these varieties as well as resistance to the prevalent major diseases. Over the past 5 years, several national programs have been encouraged by the performance of early maize and its potential for filling the hunger gap. There is tremendous opportunity for improving the overall performance and suitability of these varieties.

C) *Methodology*

- i) Develop early maturing maize populations from local materials and exotic accessions.
- ii) Use appropriate breeding systems to generate and evaluate families including assessment for disease resistance and drought tolerance

- iii) Carry out preliminary yield trials of experimental varieties and subsequently test them in regional trials

D) Expected output

- i) Improved early maturing varieties of different grain types made available by lead NARS for regional on-station and on-farm adaptive trials.
- ii) Early maturing populations with high yield and disease resistance developed
- iii) Improved early varieties released and adopted by farmers

E) Indicators for monitoring impact

- i) Number of early maturing varieties developed
- ii) Number of early maturing populations developed
- iii) Improved yield performance under drought conditions
- iv) Increase in number of varieties developed by Lead NARS in regional trials
- v) Experimental varieties available in regional on-station and adaptive trials

PROJECT 3

Breeding for disease resistant, extra-early maturing varieties

Lead countries : 2-3 national programs to be selected on competitive basis

A) *Objectives*

To develop extra-early varieties with resistance to streak and other prevalent foliar diseases in West Africa to fill the hunger gap.

B) *Background*

Through the resident research of the network coordinator in Burkina Faso, several extra-early maturing maize varieties have been developed from crosses involving local and improved germplasm. Emphasis was placed on the selection for streak resistance, improved plant type and higher grain yield, while retaining the earliness trait. Susceptibility to foliar fungal diseases such as Bipolaris maydis leaf blight and Curvularia leaf spot has also been reduced. As a result of this effort, several extra-early varieties have been made available to national programs for filling the hunger gap. In addition, several extra-early germplasm with desirable attributes are available for use in the breeding programs of NARS.

C) *Methodology*

- i) Create synthetics or breeding populations from the available extra-early germplasm
- ii) Use recurrent selection methods to improve breeding populations/ synthetics and extract experimental varieties
- iv) Conduct preliminary yield trials and identify promising varieties for on station and on-farm adaptive trials.

D) *Expected output*

- i) Availability of extra-early maturing breeding populations with high yield and resistance to major diseases.

- ii) Improved extra-early maturing varieties made available by lead NARS for regional on-station and on-farm adaptive trials.
- iii) Number of improved extra-early varieties released and adopted by farmers.

E) Indicators for monitoring impact

- i) Number of extra-early maturing breeding populations developed by lead NARS
- ii) Number of improved extra-early varieties developed and made available for regional trials.
- iii) Number of improved extra-early varieties adopted by farmers
- iv) Increase in production and productivity of farmers as a result of the adoption of improved extra-early varieties.

PROJECT 4 ✓

Striga control

Lead countries : 2-3 national programs to be selected on competitive basis.

A) Objectives

- i) To incorporate resistance/tolerance to Striga hermonthica into adapted maize varieties with high yield potential, desirable agronomic traits and grain quality.
- ii) To develop and/or promote integrated striga control management technologies that are effective and appropriate to the resource poor maize farmers.

B) Background

One of the major biotic constraints to increased maize production in the savanna zone of West Africa is the parasitic weed, *Striga hermonthica*. *Striga* causes not only high yield losses, ranging up to total crop loss but also it can compel farmers to abandon maize cultivation entirely. *Striga* sick plots have been established in Ghana, Cameroon and Benin for screening for *Striga* resistance with the technical backstopping from IITA. A number of promising *Striga* tolerant materials have been identified and are being used in the breeding programs. Also, evaluation of cultural practices for control of the incidence of *Striga* is in progress in Ghana and Cameroon, while Burkina Faso and Togo are working on biological control of *Striga*. The network would work closely with the *Striga* research group of IITA and participate actively in the IITA *Striga* trap crop project comprising IITA and the following NARS : Côte d'Ivoire, Kenya, Nigeria, Senegal, Tanzania and Zimbabwe.

C) Methodology

- i) Incorporation of *Striga* resistant genes into available varieties and breeding materials by lead centres.
- ii) Assessment of the potential of biological control strategies against *Striga*. These may include the use of biological control agents such as fungi, nematodes and smicronyx weevil in *Striga* parasitism.
- iii) Identification and improvement of appropriate cultural practices which will contribute to reduction of losses due to *Striga*. The cultural practices may include traditional weed control practices such as the heaping of soil up onto the ridge during weeding.
- iv) Evaluation of cheap herbicides such as Dicamba for effective pre-emergence *Striga* control.
- v) Identification of trap crops that cause suicidal germination of *Striga* and are economically feasible for the savanna zone.

- vi) Identification of different crop rotations and crop mixtures.

D) Expected output

- i) Availability of maize varieties with significant levels of tolerance/resistance to Striga and high yield.
- ii) Availability of integrated striga control packages that are economically feasible for farmers in different socio-economic settings.
- iii) Increased capability of NARS to efficiently screen trap crops/cultivars, to integrate them into the farming system and to make recommendations specific to locally prevailing conditions.

E) Indicators for monitoring impact

- i) Number of Striga resistant/tolerant varieties released and adopted by farmers.
- ii) The number of integrated striga control packages available.

PROJECT 5

Agronomic research for intermediate, early and extra-early maturing varieties.

Countries: All collaborating NARS.

A) Objectives

- i) To refine the existing management practices for the intermediate, early and extra-early maturing maize varieties in a way that is compatible with existing farming systems and available resources.

- ii) To establish maize-legume intercropping, relay cropping and rotation systems involving early and extra-early varieties which would ensure the best utilization of the available rainfall, reduce the risk of total crop loss by drought and improve or sustain soil productivity.

B) Background

Production recommendations such as fertilizer rates, population densities, time of fertilizer application, seed treatment and row planting have been developed for the intermediate, early and extra-early varieties and are now available to NARS. There is a need to refine the management practices and to develop more productive cultural practices. Research has demonstrated the importance of legumes in soil fertility maintenance, weed suppression and crop yield sustainability. There is a need to break the continuous maize cropping cycle through the use of suitable legumes and maize varieties for intercropping, relay cropping and rotation. The network would seek to forge linkages with the collaborative group for maize-based systems research (COMBS) of IITA (comprising Ghana, Côte d'Ivoire, Nigeria, Benin Republic, Zaire and Cameroon) as it has made good progress in this research area.

C) Methodology

- i) Evaluate different sources of fertilizer such as rock phosphate for maize production.
- ii) Address crop establishment problems using early and extra-early varieties.
- iii) Evaluate the potential of available legumes and maize varieties of the three maturity groups for intercropping, relay cropping and rotation in order to obtain a productive and sustainable natural resource base.

D) *Expected output*

- i) Development of economically feasible and appropriate management practices for the intermediate, early and extra-early varieties would have been underway.
- ii) Development of appropriate maize-legume intercropping, relay cropping and rotation systems would have been underway.
- iii) Recommendations on the use of different sources of fertilizer would be available.
- iv) Availability of recommendations for solving the crop establishment problems using early and extra-early varieties.

E) *Indicators for monitoring impact*

- i) Appropriate maize-legume intercropping, relay cropping and rotation systems for intermediate, early and extra-early varieties made available for testing in regional adaptive trials.
- ii) Improved management practices for the intermediate, early and extra-early varieties for adaptive trials.
- iii) Adoption of the recommendations for improving crop establishment.

PROJECT 6 ✓

Promotion of technology transfer

Countries: All collaborating NARS ✓

A) *Objectives*

- i) Promote technology adoption
- ii) Encourage and assist network member countries to establish and maintain research-extension-farmer linkages in their respective countries.

B) *Background*

The success of any agricultural research enterprise depends on effective linkage with agricultural extension and development institution as well as with international agricultural research institutions. There is therefore a need for the establishment and maintenance within the respective member countries of the maize network, links with institutions that conduct agronomic and socio-economic research.

There is a need to devise a strategy to ensure the strengthening of the research-extension-farmer linkage within member countries. It is therefore expected that the workplan (Appendix II) and the budget for the technology transfer component of the project would be finalized during the current meeting.

In SAFGRAD II, a number of technologies were developed or identified through network's lead centers, network coordinator's resident research, IITA and other International Research Centers. While some of these technologies have already been released by several national programs, others are currently at various testing stages (Appendix III). The technologies presented in appendix III are being proposed to member-countries for national adaptive trials.

C) Methodology

• **Strengthening researcher-extensionist-farmer linkages**

The network would encourage and assist member countries to organize the following activities in an effort to strengthen researcher-extensionist-farmer linkages within the respective countries:

- i) Annual maize workshops/research planning within member countries where they are not yet held: these would involve researchers, extensionists, policy makers and farmers. The objective would be to review research findings, grower recommendations and agricultural policies. The network would also establish links with those countries already organizing these activities.
- ii) Publication of hand books on maize for farmers and extensionists: each member country of the Network would be encouraged and assisted both technically and financially to produce handbooks on maize for extensionists and farmers. The assistance of the IITA Training Unit would be sought for this purpose.

• **Promotion of technology adoption.**

- i) Conduct on-farm tests and demonstrations using promising technologies presently in the pipeline in member countries.
- ii) Make agronomic practices in the pipeline available to NARS through training activities: special purpose seminars and group training sessions as well as monitoring tours.

D) Expected output

- i) Release and adoption of improved varieties and agronomic practices by member countries.

- ii) National program scientists trained in maize technologies.
- iii) Regional adaptive trials designed and conducted by member countries.
- iv) Production guides on maize prepared and made available to extensionists and farmers of each member country.
- v) Annual maize workshops and planning sessions organized in all member countries.
- vi) Research-extensionist-farmer linkages strengthened in member countries.

E) Indicators for monitoring impact

- i) Number of improved varieties and agronomic practices adopted by farmers.
- ii) Scientific papers presented during annual maize workshops, the number of farmers and extensionists participating in workshops and planning sessions.

PROJECT 7

√ Promotion of on-farm level seed production.

Countries: Collaborating NARS which do not have well established seed industries.

A) Objectives

- i) Promote the diffusion and utilization of suitable seed production technologies.

- ii) Provide assistance to NARS in the development of on-farm community level seed production schemes.
- iii) Facilitate the increase of breeder seed production in adequate quantities at research stations.

B) Background

Several maize varieties have been released in network member countries through the network's efforts. However, the adoption of the improved varieties is not as high as desirable partly due to lack of well-organized seed industry in some countries. The problem of lack of seed availability is most serious with the extra-early and early maturing varieties because the seed production is not as profitable as that of the intermediate and late varieties due to the lower grain yield per hectare of the early and extra-early varieties. Therefore, making available to farmers seed of the improved varieties, particularly the extra-early and early is one of the potential means of ensuring high adoption of the released maize varieties and high and stable yield.

C) Methodology

- i) Organize short-term training course for seed producers.
- ii) Encourage NARS scientists to work with selected farmers and non-governmental organizations in the development of on-farm community level seed production schemes where there is no well established seed industry.
- iii) Assist NARS scientists to produce breeder seed of released varieties in adequate quantities at research stations.

D) *Expected output*

- i) Breeder seed of released varieties available in adequate quantities in member countries.
- ii) Good quality seed of improved extra-early and early varieties made available through community level seed production schemes.
- iii) Well-trained seed producers producing seed of early and extra-early varieties at the on-farm community level.

E) *Indicators for monitoring impact*

- i) Quantity of breeder seed of released varieties produced by member countries.
- ii) Quantity of good quality seed of the extra-early and early varieties produced by member countries.
- iii) Number of seed producers trained.
- iv) Number of community level seed production schemes organized by member countries.

Research workplans for the seven collaborative projects proposed, should be submitted by lead NARS annually to the SC for review and approval. It is also proposed that the network should provide not only technical support in the design and conduct of on-farm adaptive trials and demonstrations in member countries but also some financial support for these activities.

✓ II **Regionally-oriented resident research**

The coordinator of the maize network will spend 40% of his time on research areas of his competence and which are an integral part of the network's program. The coordinator's resident research would help to

How is it possible?

maintain his professional skills and enhance his professional image vis-à-vis NARS scientists and other collaborators. The resident research would be carried out at Ferkessedougou, Sinematiali and Bouna. The following resident research activities are proposed:

- Breeding for early and extra-early varieties with resistance/tolerance to drought, striga and streak virus.
- Participate in the national variety trials including on-farm testing and demonstrations in the host country.
- Seed multiplication of maize varieties nominated for regional trials.
- Establishment of nurseries for training purposes.
- Germplasm conservation and maintenance.

As its contribution to the maize network's technology generation component, the IITA Maize Improvement Program has agreed to allocate core program funds to cover all expenses in respect of the regionally-oriented resident research.

III Regional trials

Data on promising new technologies developed or identified by the network lead centers, other NARS, and IITA or any other international center will be presented for discussion during the workshops to be organized by the network. Technologies of interest to the network would be included in the regional trials designed by the network SC for evaluation by member-countries. Regional trials would thus continue to be an important vehicle for technology exchange within the network. The regional trials will be dispatched yearly to NARS upon request. The following trials are proposed for 1994 and 1995:

- Regional Uniform Early Variety Trials (RUVT-EARLY): with the objective of identifying early cultivars, i.e. 90-95 days to maturity.
- Regional Uniform Extra-Early Variety Trials (RUVT-EXTRA-EARLY): with the objective of identifying extra-early cultivars i.e. about 82 days to maturity.
- ✓ • Regional Adaptive trials: with the objective of promoting the adoption of the network improved early and extra-early maize varieties and the accompanying agronomic practices.

IITA Maize Improvement Program has until now coordinated the variety trials for the intermediate and late groups. This arrangement is to prevent the overburdening of national programs so that the technology adapting NARS could concentrate their efforts on adaptive research. Decision must be taken as to whether this arrangement should continue.

IV Exchange of scientific information and technology ✓

Workshops serve as the fora for exchange of scientific information and new technology. Workshops are proposed for 1994 and 1995. These will allow presentation and review of the results from the previous year's regional trials and other relevant research conducted by lead and technology adapting centers, IITA and other international centers. The regional trials will be made available on request to participating NARS.

✓ A monitoring tour is proposed for the network in 1994. Scientists from selected network member-countries will visit several other national programs, including IITA, if possible. They will have the opportunity to observe and discuss in detail with scientists in the host countries, issues such as production constraints and technologies developed to overcome the constraints, research methodologies used in developing the technologies and problems faced by scientists in carrying out their research activities. The monitoring tours would not only provide a means for strong interaction among national scientists, but also would re-enforce the goals of networking.

There will also be consultation visits by the coordinator and senior NARS scientists as well as scientists from IITA to national programs.

Other mechanisms to ensure exchange of scientific information among network members would include publication and distribution of network steering committee and research director's committee reports, network annual technical report, proceedings of workshops and network newsletter.

Expected output

- Regular reporting of research directors committee and steering committee meetings.
- Publication and distribution to collaborators, network annual technical reports, compilation of results of regional trials, proceedings of workshops and a newsletter jointly prepared by the maize, sorghum and rice networks.

Indicators for monitoring impact

- Number of monitoring tours and regional workshops organized.
- Number of scientists and institutions participating in regional workshops.
- Number of scientific papers presented at regional workshops.
- Number of annual technical reports, steering committee and NARS directors of research meeting reports, compilation of regional trials results, network newsletters and proceedings of workshops published and distributed to collaborators.

✓ V Human Resource Development

In order to enhance the professional and scientific capacity of national research systems, training will be an important activity of the maize network. The network will organize annual in-service training and special purpose seminars with the assistance of the IITA Training Unit. These will focus on particular production problems or research methodologies identified by the steering committee. Participants at the different training sessions will include research scientists and technicians from the network member-countries. Some potential topics include: breeding for *Striga* resistance, methodologies for on-farm demonstrations, technology adoption and agricultural policy changes; seed production, varietal maintenance, data collection, processing and interpretation.

Expected output

- Improvement in the research capability of national scientists to carry out national and regional maize research.
- Improvement in the skill of technicians to manage trials, collect field data, and to carry out varietal maintenance.

Indicators for monitoring progress and impact

- Number of special purpose seminars and technician training courses conducted.
- Number of researchers participating in special purpose seminars.
- Number of technicians and seed producers trained.

✓ VI Impact Assessment

Given the two year duration of the project, each member country would be assisted to carry out about ten farmer interviews to collect information

which will enable the monitoring of the adaptation and release of network technologies so as to determine the impact of the research effort of the network.

Monitoring and evaluation will provide the means for assessing results against the planned objectives, introducing interim adjustments and generating feedback for future planning. It is envisaged that the collaborating NARS's capacities in monitoring and evaluation will also be strengthened.

The USAID Africa Bureau has already prepared a draft set of indicators which will assist in identifying key data set requirements. They could provide the basis for the evaluation of the project. These indicators will need to be adjusted in order to meet the project's specific needs with sufficient accuracy. They will address such issues as:

- . change in productivity and income
- . adoption rate
- . impact on resource base
- . mid-term evaluation
- . financial audits
- . end of project review

These inputs will be programmed in the annual workplans including backstopping provided by IITA and the role of the collaborating NARS.

5.0. Structure and Management of the Maize Network

It is proposed that the structure and management of the maize network be comprised the following entities:

5.1. Committee of NARS Directors

It is envisaged to establish one committee of NARS Directors for all agricultural research networks of West and Central Africa. It is proposed that the committee of NARS Directors be composed of the directors of collaborating NARS, representatives of relevant international centers including IITA and

regional agencies not included

donor representatives. The committee should meet annually as an oversight authority of the network with the following functions:

- determine policy and provide guidance in network management.
- review workplans and budgets in conformity with network objectives.
- encourage technical, administrative and financial support of the network at the national level.
- facilitate the realization of objectives of maize research and related activities.
- review annual technical progress report of the network and propose necessary modifications or termination of activities.
- identify strategies and goals and assign institutional responsibilities.

10 FARMERS
Interview

Each director of research would serve as the direct link between the maize network and the agricultural authorities of NARS which are actively engaged in network activities. The chairman of the committee of NARS Directors would be elected by his peers for a period of two years.

5.2. The Steering Committee

It is proposed that the steering committee be composed of active scientists of participating member countries and elected in such a manner as to provide for representation of a mix of disciplines. Representatives of cognate or appropriate IITA programs shall attend its meeting as observers. The steering committee shall perform the following functions:

RO

- review all workplans and budgets and allocate resources to different collaborative projects.
- prepare the agenda for biennial workshops and monitoring tours.

- monitor the implementation of network activities.

The steering committee shall meet twice a year and may co-opt persons with expertise to assist in carrying out its functions. The chairman and the secretary of the steering committee would be elected by their peers for a period of two years.

5.3. The role of IITA as the executing agency

IITA, with its long experience in network coordination of various crops across the continent, will continue to provide not only technical and managerial support but also a network coordinator during the period. IITA will continue to provide scientific, training and information resource base for the network. As an active partner, IITA will assume the following responsibilities:

- administrative and technical coordination
- accounting procedures.
- provision of funds from its core program to cover expenses of the resident research of the network coordinator.
- participation in technical reviews and provision of technical backstopping for network activities.
- technical review and editing of research findings for publication.
- assistance in identification and introduction of potentially useful maize germplasm.
- procurement and shipment of office and field supplies.
- development and logistic support of short-term in-service training, attachment courses and participation in IITA annual workplans.

- supplying consultants from its own scientific and administrative staff or from other sources.

In order to deal adequately with the research priorities of the moist savanna zone and to produce technological advances that are appropriate to the farming systems of the zone, IITA has established a station at Bouaké, Côte d'Ivoire. This station is now the coordination center of the maize network, thus bringing the network close to the source of technology generation. The station is staffed with a team of 3 scientists which includes the maize network coordinator. The station is headed by the IITA research liaison scientist who is also an experienced maize breeder/pathologist. Among the team of scientists is also the CIMMYT maize breeder who is participating in the research at the station in order to ensure the full use of CIMMYT germplasm in the development of varieties specifically adapted to the constraints and cropping systems of the sub-region. The scientists working closely together should constitute a strong team capable of setting research objectives based upon close study of the farming systems in this zone. With strong support from Ibadan headquarters, it is hoped that IITA's ability to assist national programs in the region would be improved.

6.0. Budget

6.1. National Programs

Participating member countries of the network will allocate land, office space, research personnel and other resources to establish and maintain networking activities. National maize researchers, particularly those of the lead centers, will be assigned responsibilities for which they have expertise and comparative advantage to address network constraints and other problems. It is proposed that each participating member country should make a provision in its annual budget as a direct contribution to the network effort.

6.2. The United States Agency for International Development (USAID)

The network proposal sought funding support totaling \$900,000 from the United States Agency for International Development in order to maintain the

momentum of the gains and achievements of the maize network over a period of 2 years and to facilitate the transfer of network leadership to the NARS. So far an amount of \$400,000.00 has been approved for the period october 1, 1993 to september 30, 1994. The budget as approved by USAID is presented in Table 1.

Table 1. Grant budget for 1993/1994

Item	Estimates
Coordination	139,000
Planning/Evaluation	80,000
Research collaboration	100,000
Training/Institution strengthening	30,000
Administrative support	51,000
	400,000

It is anticipated that details on network management and financial participation of NARS leading to the gradual transfer of management responsibilities to NARS would be a subject of the meeting of NARS Directors of research.

6.3. Other donors

To the extent possible, effort will be made to seek bilateral funding support from the local USAID mission in the respective countries and from other donors such as the African Development Bank, the International Fund for Agricultural Development and the Canadian International Development Agency under its new vision for regional integration in Africa.

6.4. Fund Accountability

In the past, the maize network has had problem in getting national programs to provide justification for funds allocated for collaborative research. It is believed that this problem was partly due to the fact that the financial reporting system was not well defined, despite the fact that the progress of each lead center was regularly reviewed by the steering committee. There is a

need to put in place a reporting system and a mechanism for retrieving expenditure receipts so as to ensure prompt accountability for allocated funds. Furthermore, it is expected that the meeting would devote some time to discuss the issue of the management of network funds to be allocated to national programs. This is because donors are concerned with the performance of many national programs in the way funds have been managed in the past.

7.0. Prospects for the evolution of the Maize Network

The commonality of production constraints to increased maize production and productivity, the need for cost-effective means of building national and regional capacity in the face of an era in which resources have grown increasingly constrained have necessitated the establishment of several collaborative research networks in Africa among which is the maize network for West and Central Africa.

Following the assessment of NARS research capabilities by the maize network during the Assembly of NARS researchers in 1987, national systems in West and Central Africa were categorized into lead centers and technology adapting NARS. Because of the wide variation in the levels of NARS research capabilities, a strategy was designed so that the relatively strong national programs accepted research responsibilities to serve as lead centers in specific research areas based on the comparative advantage. Research at lead centers focused on priority constraints while the technology-adapting NARS concentrated their efforts on testing and adaptation of technology. The concept of lead centers and technology adapting centers have worked very well. Emphasis of the network would therefore continue to be placed on the generation of technologies by the lead centers with effective partnership of the technology-adapting NARS to test and adapt technologies. Refinements such as the system of competitive grants are being introduced to promote high quality research, increase efficiency, ensure accountability and judicious use of resources. Also, network strategies are expected to be developed in such a participatory manner that the network would serve as a means for NARS to gain a stronger voice in determining research directions, priorities, and policies as well as increasing the amount of authority and responsibility for the management, funding and monitoring of network activities.

Through the SAFGRAD impact assessment study, some of the major weaknesses of the maize network have been identified and taken into consideration in the network structure and management. It is expected that these refinements would improve the effectiveness of the network. Efforts should be made to ensure that leadership of the network comes from the national programs through the steering committee and the research directors committee. In this way, NARS would see a growing stake in their participation in the network and there would be a growing sense of NARS ownership of the network. The network would be made sustainable by ensuring that network programs are more responsive to research and development needs of member countries and by entrenching network activities into the national research systems.

One major problem facing NARS is the lack of adequate funds for research. Large portions of national research budgets are used to cover salaries. However, national programs are now beginning to monitor and document the diffusion of technology and their impacts in order to demonstrate the returns to the investment in research to policy-makers. By so doing, it is anticipated that national governments would be convinced about the need to allocate more resources to research.

The SAFGRAD impact assessment study has clearly demonstrated that by pooling together research talents through networks, NARS have been able to attain critical research mass at regional levels which has influenced agricultural development at national levels. Through coordinated research activities of the maize network, the lead centers would be able to generate technologies that would alleviate common biotic and climatic constraints to the production of maize.

To ensure sustainability of the maize network, it has been proposed that in addition to allocating land, office space, research personnel and other resources to establish and maintain networking activities, each member of the network should make provision in its annual budget as a direct contribution to the network efforts. It is anticipated that eventually some of the NARS lead centers would develop capabilities to serve as technological base for network coordination. It is envisaged that there will be institutionalized agreements

among the governments of participating NARS to formalize the activities of the maize network. In this regards, IITA has made it abundantly clear that it would transfer the coordination of the network to NARS any time they are ready. However, continued IITA, technical and resource support to implement network collaborative projects at lead NARS centers and in technology adapting NARS is vital for the sustainability of the network activities.

As the primary beneficiary of network programmes, the sustainability of network activities in the long-run will depend very much on NARS resources input, commitment and the extent to which the research base of national research programmes is strengthened.

In order to assume leadership and management of the network, it is anticipated that the NARS would eventually assume the following responsibilities:

- i) NARS of the network would continue to support and facilitate the involvement of scientists and research administrators in network activities;
- ii) Provide leadership at regional level in research areas of comparative advantage as well as by sharing research facilities and results;
- iii) To serve as technological base for network coordination as well as contributing resources and facilitating the movement of germplasm and mobility of scientists;
- iv) Through Network Steering Committee and the Directors of research committee, provide active leadership in the identification and development of network programs.
- v) In corporation with IITA, facilitate the coordination and implementation of network programmes.
- vi) Support the coordinator's post to the network by covering coordinators salaries and local expenses.

vii) Provide logistic support for workshops, seminars, training and for related activities.

Appendix I. Maize production trends in some countries of West and Central Africa

Country	Production 1990		Maize area % of cereals 1988/90	Percent of total maize planted to improved varieties in 1988
	x1000ha	x1000tons		
Benin	485	455	73	41
Burkina Faso	221	257	8	27
Cameroon	440	600	47	18
Chad	45	31	NA	NA
Côte d'Ivoire	670	530	49	10
Ghana	567	750	47	43
Guinea Conakry	94	108	NA	NA
Mali	126	228	20	36
Mauritania	4	3	NA	NA
Niger	15	80	NA	NA
Nigeria	1500	1600	14	40
Senegal	105	110	5	100
Togo	255	245	44	15

Source: 1989/90 CIMMYT World Maize Facts and Trends

Appendix II. Proposed workplan of Maize Network for West and Central Africa for the period October 1, 1994 - September 30, 1995 (for adoption by Steering Committee)

Date	Activity	Location	Implementors
October, 1993	Cooperation/Grant Agreement signed Announcement of meeting of committee of NARS directors and workshop of NARS scientists.		
January, 1994	Dry season nursery activities		
Jan-March , 1994	<p>a) Workshop of NARS scientists from all member countries to (i) elect a steering committee (ii) assign collaborative projects (iii) present progress reports on research in respective countries (iv) plan regional on-station and on-farm adaptive trials.</p> <p>b) Steering committee meeting to plan future research activities, monitoring tours, training programs, consultation visits and other relevant network activities.</p> <p>c) Meeting of committee of NARS directors to approve network structure, composition and coordination, collaborative projects, technology transfer and resident research components of the network and the budget</p>		
May/June, 1994	Field trials, adaptive trials, demonstrations, breeding nurseries and seed production. Technical training.		
<i>mid September</i> August, 1994	Monitoring tour to selected network member countries.		

Appendix II (cont'd). Proposed workplan of Maize Network for West and Central Africa for the period October 1, 1994 - September 30, 1995 (for adoption n by steering committee)

Date	Activity	Location	Implementors
October, 1994	Special purpose seminar for NARS scientists		
November, 1994	Steering committee meeting		
January, 1995	Dry season nursery		
February, 1995	National maize workshops and planning sessions of network member countries		
March/April, 1995	a) Biennial workshop for presentation of scientific papers, progress reports on collaborative projects, in-country reports covering the period 1991 - 1994		
	b) Steering committee meeting to plan future research, monitoring tours, training programs, consultation visits and review of progress on collaborative projects.		
May/June, 1995	Conduct of field trials, demonstrations, breeding nurseries and seed production.		
	Seed production course		
	Evaluation		
July/August, 1995	Preparation and submission of draft final report		
September, 1995	Project activity completion date		

Appendix III. Promising technologies at the network level for promotion
by maize network

a) Maize varieties

<u>Attributes</u>	<u>Names of varieties</u>
1. Extra-early varieties	(Across 8131 x JFS) x Local Raytiri, CSP-SR BC5 CSP x Local Raytiri, Pool 27 x Gua 314, Pool 28 x Gua 314, Pool 30 x Gua 314, TZEE-Y SR, TZEF-Y, TZEE-W-SR, TZEE SR-W x Gua 314
2. Early varieties	Across 90 Pool 16 DT, Farako-Bâ 90 Pool 16 DT, Ina 90 Pool 16 DT, Kamboinse 90 Pool 16 DT, Maroua 90 Pool 16 DT, Nyankpala 90 Pool 16 DT, Maka SR, Dorke Sr, Kamb. 88 Pool 16 DT

b) Improved agronomic practices

- i) Tied ridges for soil moisture conservation in Sudan Savanna.
- ii) Better seed treatment chemicals for improved plant establishment and grain yield
- iii) Increased plant population for higher grain yield of early and extra-early varieties
- iv) Earlier date of fertilizer application (top dressing) for increasing yield of early and extra-early varieties

References

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