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SAFGRAD II

MAIZE AND COWPEA COLLABORATIVE RESEARCH NETWORKS FOR WEST AND CENTRAL AFRICA

ANNUAL REPORT
1990/91

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INTERNATIONAL INSTITUTE OF TROPICAL AGRICULTURE
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PREFACE

This report covers the activities of the IITA/SAFGRAD Project on the Maize and Cowpea Collaborative Research Networks for West and Central Africa for the period April 1, 1990 to March 31, 1991.

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

ABBREVIATIONS

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

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

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

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

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

Ouagadougou
May, 1991

Joseph M. Fajemisin
Project Leader and
Coordinator, Maize
Research Network.

DECLARATION

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

IITA/SAFGRAD PERSONNEL

Principal Staff

Dr. J.M. Fajemisin	Maize Network Coordinator and Project Leader IITA/SAFGRAD
Dr. N. Muleba	Cowpea Network Coordinator

Support Staff

Mr. Jeremy Ouedraogo	Research Associate, Cowpea Breeder (Until 31 August 1990);. Consultant (from 1 September, 1990).
Mr. Boukari Bandaogo	Accountant and Store Supervisor
Mrs. Rachel Ouedraogo	Secretary
Mr. B. Morgan Kamboke	Secretary
Miss. Aminata Bohena	Secretary
Mr. Raymond Sanduidi	Field Technician (Maize)
Mr. Victor Tapsoba	Field Technician (Cowpea)
Mr. Joseph Bationo	Field Assistant (Maize)
Mr. Maurice Sawadogo	Facilitation Clerk (until 31 December, 1990)
Mr. Seydou Ouedraogo	Mechanic-Driver
Mr. Martin N. Akpaloo	Driver-Mecanic
Mr. Cisse Issa	Driver
Mr. Daniel Ouedraogo	Office Boy

INTRODUCTION

SAFGRAD Phase II is an extension of the original SAFGRAD Project whose global objective was the enhancement of the productivity and production of essential food grain crops in the semi-arid zone, namely, sorghum, millet, maize and cowpea. In reviewing the progress made in SAFGRAD Phase I and deliberating on the thrust of SAFGRAD Phase II, the Council of Directors of Agricultural Research from SAFGRAD member countries at their meeting of 23-27 February 1987 at Ouagadougou decided that collaborative research networks should be established for maize, cowpea, millet and sorghum. The major emphasis of the Networks is to exploit and maximize the use of limited resources and expertise of scientists within the region to strengthen NARS research capabilities in order to achieve the objectives of their respective national programs. IITA accepted responsibility for implementation of the Maize and Cowpea networks for the West and Central Africa sub-region. The other two, namely, West and Central Africa Sorghum Collabotive Network and East African Sorghum and Millet Collaborative network were contracted to ICRISAT.

In pursuance of the decisions of the NARS Directors of Research, the SAFGRAD Coordination Office (SCO), in collaboration with IITA, organized a workshop for scientists working on maize and cowpea in the 18 SAFGRAD member countries in West and Central Africa from 23 to 27 March, 1987 at Ouagadougou. Researchable production constraints in maize and cowpea were inventorized by national scientists during the Workshop together with the infrastructure, resources and skilled manpower available in the sub-region. This permitted the development of a strategy that recognizes the requirements and potentials of both the strong and weak national programs specific to each Network.

A Steering Committee of 6 competent national full-time scientists and the Coordinator of the relevant network together with an observer each from IITA, USAID and SAFGRAD Coordination Office was elected for each network by the national scientists with the responsibility of planning and monitoring the activities of the Network. The Committee established research priorities for the Network and assigned research responsibilities to relatively strong national programs referred to as "Lead Centers". For each Network, promising technologies developed by IITA-Ibadan, IITA/SAFGRAD's resident research and including, in the case of maize, CIMMYT were identified and the respective Coordinator mandated to therefrom design regional trials for distribution, on request, to national programs.

The Monitoring Tours conducted in 1988 and 1990 and the Workshops of 1989 and 1991 provided opportunity to report on and exchange research findings. These and other Network activities have improved linkages within NARS and with the IARCs.

This report which covers the period of April 1, 1990 to March 31, 1991 highlights the following aspects for each Network.

- Collaborating national programs/scientists,
- Management of the Network,
- Strengthening national programs,
- Major problems encountered, and
- Recommendation for improvement and follow-up activities for the next year.

For more details, questions or clarification, please address your enquiries to either the respective Network Coordinator or the National Project Coordinator of the country concerned.

EXECUTIVE SUMMARY

The principal objective of establishing the Maize and Cowpea Collaborative Research Networks for West and Central Africa is to develop the capacity and initiative of the NARS maize and cowpea scientists to carry out research for the generation of appropriate technologies. Outputs from each Network have revealed many indicators of progress to the attainment of the Project objective. The Steering Committee continues to take leadership role in program planning, execution and appraisal.

The Steering Committee assured the activities of the Network through its biannual meetings and consultation visits to the national programs. At the eighth meeting held 5-8 November, 1990 at Cotonou, Benin Republic, the activities of the Networks during the growing season were reviewed. The participation of the Directors of both IITA Maize and Grain Legume Programs facilitated an in-depth discussion of technical backstopping of NARS by IITA. The ninth meeting (Niamey, Niger 13-14 March, 1991) permitted the Steering Committee of each network to discuss the results of the collaborative research and other activities of the year and to plan for the following year.

The year witnessed significant improvement in the initiatives of the Networks on agronomic research. There was increased research activity on the agronomic component of the varieties developed for the semi-arid zone. An inter-network (maize, cowpea, and sorghum) seminar for research agronomists was held at IITA-Ibadan, 7-19 January, 1991. Twenty scientists from 12 countries participated. The objectives of the seminar were to discuss crop production constraints, the concept of low input technology and to identify areas that deserve agronomic research priorities.

The regional trials coordinated by the Networks continued to be a forum for the exchange and evaluation of technologies by the scientists for the zone. Of the 60 sets of maize trials requested and received by 15 countries, data were returned for 54 sets, showing an unprecedented 90% recovery. Promising early and extra-early varieties were identified for on-farm testing. Highlights from the cowpea regional trials revealed that cultivars B 301, IT82D-849, SUVITA-2, TN 93-80, and TN 121-80 were remarkably resistant to Striga but SUVITA-2 was Striga infested in some areas of Niger and Nigeria.

The Networks sponsored several activities to improve linkages of the component member-countries and scientists. Monitoring Tours were organized for maize scientists from eight countries to visit Cameroon and Nigeria whilst the Cowpea Network also successfully carried out a monitoring tour of scientists from seven countries to Burkina Faso, Niger and Nigeria. The visits of Coordinators and members of Steering Committees to assigned countries provided necessary on-the-spot assistance and enhanced interaction among the Network practitioners. The Maize Network organized its third 5-month technician training which improved the skill and motivation of participants from six countries.

The Inter-Network Workshop of the Maize, Cowpea and Sorghum SAFGRAD Networks held in Niamey, Niger 8-14 march, 1991 allowed invaluable exchange of views and experiences among grain-crop scientists from the West, Central and Eastern Africa. There were 147 participants from 23 countries. Research findings were presented, the network strategy reviewed and work-plans discussed. The assembly of scientists from each Network carried out election for the stipulated biennial reconstitution of the Network Steering Committee membership.

Major problems encountered and recommendations for improvement and follow-up activities for the next year are also discussed in this report.

SECTION A

MAIZE NETWORK ANNUAL REPORT 1990/91

I. COLLABORATING NATIONAL PROGRAMS AND NATIONAL PROJECT COORDINATORS

1.1. MAIZE NETWORK LEAD CENTERS

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

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

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

4. Ghana
   - Research responsibilities : Breeding for maize of different maturities and for streak resistance :
   - Project Coordinator : Dr. B. Badu-Apraku
     Crops Research Institute
     P.O. Box 3785, Kumasi

5. Nigeria
   - Research responsibilities : Agronomy
   - Project Coordinator : Dr. K.A. Elemo
     Institute of Agric.
     Research, Samaru
     PMB 1044, Zaria

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

1.2. OTHER MEMBER-COUNTRIES

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

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

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

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

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

Guinée-Bissau : Mme Isabel Miranda
C.P. 71, Bissau

Mali : Mr. NTji Coulibaly
Station de Sotuba, B.P. 438 Bamako

Mauritania : Mr. Sidi R'Chid
CNRADA, B.P. 22, Kaedi

Niger : Mr. Jika Naino
INRAN, B.P. 429, Niamey

Senegal : Mr. Abdou Ndiaye
ISRA, B.P. 240 CRA/Fleuve
Saint Louis

Tchad : Chef du Bureau
de la Recherche Agronomique
Ministére de l'Agriculture
B.P. 441, N'Djamena

II. NETWORK MANAGEMENT

The activities of the Network for the year were planned and monitored by the Steering Committee. There were two meetings of the Committee during the year under review.

2.1. EIGHTH STEERING COMMITTEE MEETING

The eighth of the biannual meetings of the Maize Steering Committee took place November 5-8, 1990 at Cotonou, Republic of Benin.

The following people were in attendance :

- **Members of the Steering Committee**

Dr. Charles Thé (Cameroon) --Chairman
Dr. B. Badu-Apraku (Ghana) --English Secretary
Mr. Abdou Ndiaye (Senegal) --French Secretary
Dr. M. Esseh-Yovo (Togo)
Mr. Koffi Attiey (Côte D'Ivoire)
Mr. Romuald A. Dossou (Benin)
Dr. J.M. Fajemisin --Network Coordinator

- **Observers and resource persons**

Dr. T. Bezuneh	(Director of Research, SAFGRAD, Ouagadougou, Burkina Faso)
Dr. K.A. Elemo	(Agronomist, Institute of Agric. Research, Samaru, Zaria, Nigeria)
Dr. M.D. Winslow	(Director, Maize Research Program, IITA, Ibadan, Nigeria)
Dr. J.C. Sentz	(USAID-IITA Liaison Officer, IITA, Ibadan, Nigeria)
Mr. E.F. Deganus	(Projects' Coordinator, International Cooperation IITA, Ibadan Nigeria)
Dr. S.T.O. Lagoke	(Coordinator, Pan-African Striga Control Network IAR/ABU Zaria, Nigeria)

The followings were discussed at the meeting :

(i) Mid-year report of the Network Coordinator,

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

(iii) Report on visits by the Steering Committee members to national programs,

(iv) Report on 1990 Monitoring Tour,

(v) Exchange of ideas with IITA Maize Program Director on issues concerning maize research in the sub-region,

(vi) Proposal for extension of SAFGRAD Phase II,

(vii) Plan for 1991 regional trials, and

(viii) Plan for the joint maize-cowpea-sorghum seminar for research agronomists.

Highlights

1. The IITA Maize Program Director, Dr. M.D. Winslow up-dated the Committee on the priorities and strategy of the Maize Program with emphasis on improving the efficiency of collaboration between the Program and NARS.

2. Members of the Committee took advantage of the participation of the Maize Director to elaborate on NARS requirements for backstopping from IITA particularly in the type and content of courses available at IITA and germplasm delivery.

3. Presentation on visits of Steering Committee members to national programs demonstrated the usefulness of exchanges between weak versus strong NARS and also among the strong NARS in exchange of techniques and technologies

4. The 1990 Monitoring Tour Report was presented and discussed.

5. The report of the SAFGRAD-CORAF Networks Harmonization committee meeting was discussed.
6. Proposal for a 13-month extension of the present phase of the Project until the commencement of a follow-on phase was discussed.

Recommendations

The Steering Committee made the following recommendations.

1. In view of the lack of serious attention to storage and utilization in member countries, it is recommended that NARS and IARCs should intensify research on maize utilization and storage in West Africa and Central Africa.

2. In view of the confusion surrounding terminologies of resistance and tolerance and the various scales for scoring for biotic and abiotic stresses and plant characters, it is recommended that the issue be discussed at the 1991 workshop in Niamey

3. Having assessed the impact of IITA Maize training courses on the Network, it was recommended that the present long term course should be alternated annually with short, intensive, topic-specific training courses; with the long term course, classroom work should not occupy more than 30% of the time devoted to the entire course. In addition, the type of training, in which trainees are attached to particular scientists for variable period of time to learn on the job, should continue.

4. In view of the crucial role expected of the technical back-stopping of SAFGRAD maize activities by IITA, the Committee expressed concern over the present procedure of appointing core scientists of IITA. It is strongly

recommended that such positions should be properly and widely advertised in order to attract the best candidate while at the same time giving particular emphasis to the ability of the scientist to effectively interact with NARS scientists.

5. While appreciating the role of IITA in finished variety development, the Network recommends that more emphasis should be placed on the development of heterotic groups up to the inbred line stage, so that finished product development could be delegated to NARS.

6. In view of the importance of the streak virus disease in West and Central Africa, and the availability of several good streak resistant varieties, the Committee recommends that only streak resistant varieties should be tested in the international and regional trials.

7. In view of the scheduled end of SAFGRAD Phase II, on 31 August, 1991, and the likelihood that SAFGRAD Phase III will not commence before October 1992, the Committee strongly recommends that a bridging of 13-month extension of SAFGRAD Phase II (from September 1, 1991) be granted by the donors

Details of the deliberation and decisions taken are provided in the"Report of the Eighth Steering Committee Meeting."

2.2. NINTH STEERING COMMITTEE MEETING

The meeting was held during the biennial Workshop of the maize scientists at Niamey, Niger on 14 March 1991, a day after the reconstitution of the Steering Committee by the assembly of the national maize scientists.

The following people were in attendance :

- Members of the Steering Committee

Dr. Charles Thé (Cameroon)	--Re-elected Chairman for 1991/92
Dr. Peter Y.K. Sallah (Ghana)	--New member and elected English Secretary
Mr. Ntji Coulibaly (Mali)	--New member and elected French Secretary
Mr. Abdou Ndiaye (Senegal)	--Retained old member
Mr. Romuald A. Dossou (Benin)	--Retained old member
Dr. E.N.O. Iwuafor (Nigeria)	--New member
Dr. J.M. Fajemisin	--Network Coordinator

- Observers

Dr. G. Kingma	--USAID SAFGRAD Project Officer, SCO, Ouagadougou
Dr. M.D. Winslow	--Director, Maize Research Program, IITA, Ibadan, Nigeria
Dr. S.K. Kim	--Maize Breeder, IITA, Ibadan, Nigeria

The followings were discussed at the meeting:

(i) Regional Trials for 1991

(ii) Collaborative Projects

(iii) Training Course on Computer,

(iv) Formation of discipline-based working groups, and,

(v) Plan for visits to national programs.

Highlights

1. The composition of the 1991 regional trials was discussed and ratified.
2. Participants met as working groups according to their research disciplines and each group brainstormed on research priorities and approaches towards their implementation.
3. While the current Lead Centers were ratified to continue on

their assigned roles, Ghana added nitrogen-use efficiency to her research assignments and Striga research will be conducted by Côte D'Ivoire, Ghana and Togo as Associate Centers in addition to Cameroon which is the Lead Center on this research issue.

Recommendations :

The Steering Committee made the following recommendations:

1. In view of the increasing level of maize production in SAFGRAD member countries, it is recommended that NARS and IARCs should intensify research on maize utilization in West and Central Africa.

2. In view of the crucial role expected of entomologists and plant pathologists, it is clear that there is an alarming scarcity of well-trained scientists in these areas throughout West and Central Africa. It is recommended that each country should make extra effort to train crop protectionists.

3. Many maize scientists have expressed the need to standardize scoring systems for biotic and abiotic stresses in order to facilitate comparison of research results. It is recommended that scientists adopt the 1-9 rating scale for Striga, streak, drought stress, and other biotic and abiotic stresses.

4. The importance of research in the agricultural and the overall economic development of African countries cannot be over-emphasized. Several biotic and abiotic factors limit agricultural production in African countries south of the Sahara and research is urgently needed to address these problems. This cannot be done without sufficient research funding. It is recommended that governments for West and Central African countries should provide enough funds to enable agricultural research to be conducted in their respective countries.

5. In view of the rising cost of fertilizers, it is recommended that any fertilizer recommendation should be backed by economic analysis.

Details of the deliberation and decisions taken can be obtained from the "Report of the Ninth Steering Committee Meeting".

III. STRENGTHENING NATIONAL PROGRAM

3.1. COLLABORATIVE RESEARCH

During the year, the Lead Centers continued to implement research projects that are of common interest to the Network. Also, the uniformly designed regional trials of improved maize varieties in the sub-region were conducted by 16 of the 17 Network member-countries.

3.1.1. Technology Development by Lead Centers

CAMEROON

Development of early maturing varieties. Two early maturing synthetics were developed from S3 lines extracted from the cross CMS 8503 x DMR-ESRW. The lines had earlier been testcrossed to the inbreds 1368, 5012 and 9071, and to the base population itself. The synthetics were advanced to F2.

Development of drought tolerant maize. Ninety S3 lines from the NCRE drought resistant pool were tested at 2 locations under two moisture regimes : tied and simple ridges. Families were selected for the development of a drought resistant synthetic.

In addition, partial diallel crosses were made using the following materials which have shown promise for drought tolerance or some other desirable characteristics : Maka, Blanc-2 Precoce, CSP, Jaune Flint de Saria, Tuxpeno drought, KU 1414-SR, NCRE line 37, and IITA line 9848. The F1 crosses were evaluated at two locations : Soucoundou and Maroua. Heterotic pools will be made and crosses showing good specific combining ability will be advanced to F3 and tested as varieties.

Development of Striga resistant maize. Five sets of inbred lines were evaluated in 1990 under artificial Striga infestation. Rating for Striga damage was done 10 and 12 weeks after planting. Lines showing the least damage had been identified for developing Striga resistant maize population.

Agronomic package for early and extra-early maize. Cameroon has identified early (DMR-ESRY and Pool 16 DR) and extra-early (TZEF-Y) varieties of 95 and 80-85 days maturity, respectively for areas within the ishoyetes 700 and 900 mm. On-and off-station experiments showed that high yields of these varieties can be achieved by combining 90 kg N/ha with a population of 62,500 plants/ha. The side dressing of urea must, however, be applied 20 days after seedling emergence in contrast to 30 days after emergence for medium to late maturing varieties.

GHANA

Development of maize varieties of different maturities. In order to generate maize varieties for different ecologies of varying lengths of growing season, Ghana maize program has established five breeding populations (i.e. 120-day, 105-day, 95-day white dent populations, the 120-day yellow flint/dent and the 95-day yellow flint populations) and two back-up gene pools (i.e. 120-day and 105-day white dent pools). In 1990, steps were initiated to extract experimental varieties from the pools and populations.

Full-sib families were generated in the 90-day white dent population, 105-day white dent pool and population, and the 120-day white dent population for progeny evaluation in 1991. To exploit the rapidly increasing demand of the poultry industry for yellow maize, a program was initiated in 1987 to convert the high yielding adapted EV 8443-SR to yellow through backcrossing using Golden Crystal as the donor for the yellow color. During 1990, the BC4 S1 was advanced to BC4 S2 stage and selection for deep yellow kernels was emphasized. Selected families were recombined and the resulting material will be included in variety trials in Ghana in 1991 to monitor progress made so far.

Improvement of streak resistance levels of some elite varieties. Dorke, an early, white dent variety was extracted in Ghana from Pool 16 SR in 1987. The results of streak resistance evaluations carried out in IITA in 1988 revealed that Dorke had a moderate level (53%) of resistance. Utilizing the streak resistance facilities at IITA, Ghana scientists had raised the resistance level to 95%. Seeds of the improved Dorke had been increased for distribution to farmers. Similarly, Aburotia, an intermediate maturing white dent maize from Population 49, has been replaced by combining two streak resistant varieties from this population : Ikenne 8149-SR BC2 and Ikenne 8149-SR BC5. After intensive selection for yield and streak resistance under high streak pressure, a new variety, Abeleehi, has been developed with high streak resistance level and grain yield superior to Aburotia.

Inbred line development and formation of two heterotic populations. Recognizing the potential part that hybrid maize technology could play in the improvement of yield and revolutionize agriculture in Ghana, a hybrid programme was initiated in 1986. Inbred development in Composite W and Giant composite has been going on since 1987. The inbred lines are currently at the homozygous state (S6) and have been crossed to 4 testers of varying genetic backgrounds (i.e. 9071, 5012, 2097 and 1368) in an attempt to classify

`them into different heterotic groups. Diallel studies at CIMMYT have shown that Pop 44 combines very well with Pop 43. Inbred line development has therefore been going on in EV 8444 SR BC4 since 1988. During 1990, the S3 lines were advanced to the S4 stage and also topcrossed to Ejura 7843 and the population itself.

Based on yield and agronomic potential, the 120-day white dent population was identified as the female parent for hybrid development in 1986. A male population with high heterosis in crosses with the female population is being developed for hybrid development. Results of topcross evaluations have revealed that TZB-SR, EV 8444-SR BC4, and CIMMYT Pop. 42 combine well with the 120-day white dent population. Compositing of the three materials was initiated during the major season of 1989 and the programme taken through a cycle of half-sib recombination during the major season of 1990 and advanced in the minor season.

Testing some Ghana inbred lines in hybrid combination. In addition to the inbred lines generated from Ejura 7843, selection and inbreeding was continued in segregating lines (S3) of Tuxpeno background received from IITA and CIMMYT. Results of ear and stalk rot, maize streak virus and stem borer (*Eldana saccharina*) evaluations carried out in IITA in 1988/1990 have revealed that some of the Ghana inbreds have high levels of resistance and could be utilized in developing resistant hybrids and synthetic varieties. Testing in hybrid combinations of some of the 43 tropically adapted Ghana inbreds was initiated at 3-5 representative locations in Ghana (Ejura, Kwadoso, Kpeve, Damongo and Nyankpala) during the major season. Selected lines from the IITA maize research program were used as testers. Five trials were conducted. The first three trials involved single cross hybrids formed by crossing some Ghana inbreds and some selected IITA inbreds (testers). The fourth and fifth trials involved a group of three-way cross hybrids derived from crosses between some Ghana inbreds and 1368 (IITA inbred) as the female parent and either 9071 or 5012, also from IITA, as the male parent.

In the hybrid trial I, grain yield ranged from 5.9 tons/ha for GH17 x 9071 to 3.5 tons/ha for GH6 x 2097. The hybrid GH17 x 9071 out-yielded Okomasa by 31% and the best IITA hybrid check, 8321-21 by 4%. The results of the hybrid trial 2 revelead GH31 x 2097 as the most outstanding entry, outyielding Okomasa and 8321-21 by 23 and 26%, respectively. In the third hybrid trial, GH5 x B73 gave the highest grain yield while GH6 x Ku1414 gave the lowest grain yield. GH5 x B73 outyielded 8321-21 by 28% and Okomasa by 30%. The results of the hybrid trial 4 showed that the 3-way crosses (GH31 x 1368) x 9071, and (GH34 x 1368) x 9071 outyielded Okomasa and 8321-21 by 30% or more. In the hybrid trial 2, (GH23 x 1368) x 5012 which was the most outstanding entry, outyielded the checks, Okomasa and 8516-12 (3-way hybrid) and 8321-21 by 13%, 22% and 28%, respectively. All the 3-way hybrids had desirable plant height and were acceptable as full season varieties.

Inheritance of floury endosperm in local maize. The inheritance of the soft and floury endosperm of some local maize varieties from Ghana, Togo and Cameroon was studied using five generations derived from a cross between each local variety and a normal endosperm variety (F1, F2, and the reciprocal backcrosses). Results showed that Ghana and Togo locals possess seemingly identical recessive gene for the floury endosperm. The Cameroon local, however, possessed a different single recessive gene for the floury endosperm.

Improvement of nitrogen use efficiency of maize. There is a need for maize varieties which utilize nitrogen fertilizers more efficiently so that the amount of fertilizer currently recommended for maize could be reduced without any serious effect on productivity. This is very important in view of the high fertilizer prices resulting from the removal of subsidies on fertilizer by the Governement. During the major season of 1990, a program was initiated to improve the nitrogen use efficiency of the 120-day white dent (120 DWD) population. Full-sib families were generated in the 120 DWD population for evaluation under low and high nitrogen levels in 1991.

Development of quality protein maize. The National Maize Program of Ghana is under pressure to release a quality protein variety in Ghana as soon as possible. Across EV 8363 SR, a quality protein variety developed by CIMMYT had been found to have good yield and desirable grain type and was therefore under consideration for release in Ghana. However, its streak resistance was not at an acceptable level.

The variety has been improved during the year through controlled infestation with viruliferous insects, selecting the resistant plants and advancing the dent-grain fraction. This new version has been designated GH8363-SR and proposed for release in Ghana in 1991 based on the results of SR level evaluation carried out during the 1990 B season which revealed that 95.7% of the plants are streak resistant, compared to 60.6% for Across EV 8363 SR.

TOGO

Development of streak resistant varieties. The National Program continued to improve its streak resistance screening techniques. A continuous production of viruliferous leafhoppers has been attained. Two populations (AB 12 and AB 13) were under improvement using S3 or S4 lines. Selection emphasis is on plants that combine good yield with streak resistance, good husk cover, soft endosperm and prolificacy at low plant density.

Evaluation of two different sources of streak resistance. Two streak resistant lines, namely Tzi 3 (1368) from IITA and CVR3 (Revolution) from the Reunion, were tested for their levels of resistance to the maize streak virus (MSV). Ratings for streak symptom on a scale of 1-5 done three times at 21-day interval were 4.4, 3.9 and 3.9 for Tzi3 and 3.8, 3.2 and 3.1 for CVR 3. The CVR 3 x Tiemantié F1 cross scored 3.8, 2.6 and 2.0, most likely due to the streak intensity decreasing with plant age and/or as a result of hybrid vigor.

NIGERIA

Fertilizer requirement for maize/cowpea mixture.

Maize (variety TZB-SR) was interplanted with cowpea (local variety Kananado) at Samaru, Nigeria in the northern Guinea Savannah zone at four levels of nitrogen (0, 75, 150 and 225 kg N/ha), three levels of phosphorus (O, 40, and 80 kg P205/ha) and two levels of potassium (0 and 60 kg K20/ha) during the 1990 growing season. The sources of N, P and K are calcium ammonium nitrate, single superphosphate, and muriate of potash, respectively. All fertilizer treatments were applied only to maize and none to cowpea.

Maize grain yields increased up to 75 Kg N/ha after which it levelled off. Maize responded significantly to P up to 40 kg P205/ha. There was no response to K. All the interactions were significant for grain yield, ear height, and 100-grain weight but only the PK interaction was not significant for plant height. Increasing N level increased plant height up to 150 kg N/ha. P and K had no effect on plant height. For cowpea, N application depressed grain yield significantly but there was positive response to P at 80 kg P205/ha. Application of K increased grain size.

Response of maize to zinc. Field trials were conducted at five locations in the semi-arid zone of Nigeria during 1988-90, to study the effects of various rates of zinc fertilizer on maize yields. The treatments were absolute check, zinc check, 1, 2 and 3 kg Zn ha-1. Maize grain and straw dry mater yields increased with increasing zinc additions across all locations. The HC1-extractable Zn in all the soils which ranged from 1-2.0 mg/kg are between the deficiency and critical limits for maize and that explains the response pattern obtained in the study. The optimum Zn fertilizer rates for the soils studied seem to range between 1-2 kg Zn ha-1.

Field evaluation of Nigerian-made granular urea. Field trials were conducted at five locations in the semi-arid zone of Nigeria during 1988-90 to evaluate the efficiency of Nigerian-made granulated urea fertilizer along with imported prilled urea and calcium ammonium nitrate (CAN) at rates of 0, 50, 100 and 150 kg N/ha applied as surface uncovered and surface covered. Source, rate and method interactions were not significant at all locations although there was significant method x rate, method x source and source x rate interactions at two out of the five locations. Generally, the Nigerian made urea gave higher grain and straw dry matter yields than prilled urea but slightly lower yields than (CAN) at all locations.

The optimum N requirement for maize in all the locations were observed at between 100 and 150 kg ha-1. Although grain yields were not affected by methods of application, there was evidence that surface covered seem to be superior at the drier locations. All three sources of nitrogen fertilizer at rates higher than 100 kg ha-1 had varying acidifying effects on the soil pH, the order of magnitude being CAN < granulated urea < prilled urea.

BURKINA FASO

In collaboration with the National Program of Burkina Faso the following activities were carried out by the Network Coordinator.

Development of drought resistant maize. One hundred and sixty five full-sib families generated from Pool 16 DR C3 were evaluated under five different environments in four countries (Benin, Burkina Faso, Cameroon, and Ghana). In Burkina Faso, the trials were sown at high plant density (133,332 plants/ha) at Farako-Bâ and under two levels of soil moisture (using tied and simple ridges) at Kamboinse. Except for Kamboinse where the families were grouped into experiments of 20 entries each, the trial was conducted as 13 x 13 lattice of three replications.

The trials experienced serious drought conditions at Nyankpala (Ghana) and Kamboinse (Burkina Faso). This provided the desired opportunity to select for drought tolerance/resistance. At Farako-Bâ, the trial was conducted in a plot of land highly deficient in zinc; since constant rains prevented the plants from benefiting from the foliar-applied zinc sulphate, we took advantage of the situation to select for families that performed under such condition. The best 10 full-sib families were selected from each trial location and across locations to form experimental varieties. Particular attention was paid to eliminating families with poor agronomic characteristics such as high ear placement, lodging, foliar diseases, poor husk cover, ear rots and flint grain type. The best 55 families across sites were selected for generating Pool 16 DR C4.

Improvement of extra-early and early maize for streak resistance. During the year, in collaboration with the IITA Maize Program at Ibadan, three extra-early maize varieties (TZEE-W, TZEE-Y, and CSP) were advanced to BC3 F3 under artificially induced high streak pressure. As a result of the endemic nature of H. maydis blight and Curvularia leaf spot in the humid location (Ibadan), it was possible to improve resistance to these foliar diseases. Two early maturing local varieties well appreciated for their grain type and/or adaptation (Blanc 2 Precoce from Benin Republic and Maka from Mauritania) were also improved for streak resistance by advancing them to BC3 F3 under high streak pressure at Ibadan. The original crosses were made at Kamboinse (Burkina Faso) and advanced to BC1 F2 before forwarding them to IITA. All these streak resistant extra-early and early varieties will be included in the 1991 regional variety trials.

3.1.2. Regional Variety Trials

Regional variety trials provide the forum for national programs to evaluate their elite maize varieties across the sub-region and at the same time expose them to other national programs addressing similar ecologies. In fact, they represent the major source of germplasm for NARS scientists either for eventual release to farmers or as breeding materials for further improvement.

The Network coordinated two types of trials in 1990 namely : RUVT Early (formerly RUVT-1), and RUVT Extra-Early (formerly RUVT-3). The trial of late/intermediate varieties (formerly RUVT-2) was coordinated by IITA. This arrangement was reached to improve the delivery of germplasm to NARS in a way as to avoid duplication or over burdening.

Sixty-five sets of the trials (RUVT-Early : 36 and RUVT Extra-Early : 29) were requested by collaborators in 17 countries (Table 1). The 5 sets sent to Senegal were not delivered. Data were received from 52 sets from 14 countries. Data from all the trials had been analysed, the analyzed data from all the countries compiled and copies forwarded to all the collaborating countries.

Table 1. Number of sets of Regional Uniform Variety Trials (RUVT) requested per country, 1990

COUNTRY	Number of Trials Requested		
	RUVT-EARLY	RUVT EXTRA-EARLY	TOTAL
Benin	4	2	6
Burkina Faso	3	3	6
Cameroon	3	3	6
Cape Verde	-	1	1
Central African Republic	2	1	3
Chad	2	2	4
Côte D'Ivoire	2	1	3
Gambia	2	4	6
Ghana	2	1	3
Guinea Bissau	2	-	2
Guinea Conakry	2	2	4
Mali	2	3	5
Mauritania	1	1	2
Niger	1	1	2
Nigeria	3	2	5
Senegal	3*	2*	5
Togo	2	2	4
TOTAL	36	29	65

*Trial packets not received

There was good plant establishment in practically all the locations. The 1990 cropping can, however, not be described as favorable across the sub-region. The onset of rains was late and unreliable in many countries notably Burkina Faso, Gambia and Ghana. There were incidences of drought stress, particulaly at flowering in these and many other countries including Benin, Côte D'Ivoire, Mali and Tchad. For instance, rainfall at Kamboinse (Burkina Faso) was 595 mm compared to 764 mm in 1989 and a long-term average of 800 mm. Interestingly, Sapu (Gambia) with similar ecology (800 mm) also received only 595 mm rainfall in 1990. Under such conditions, ridge-tying at Kamboinse to conserve soil moisture increased yields of extra-early and early varieties by 66 and 200%, respectively. Eighty percent of the trials had CV values (coefficient of variation) not greater than 30%. Fifty-seven percent of all the trials recorded CV of 20% or less ; this represents some improvement in trials management and data quality over 1989 trials.

RUVT-Early

EV 8731-SR BC6 produced the highest grain yield (4.4 t/ha) across 23 locations in 10 countries. Farako-Bâ 88 Pool 16 DR (HD) was the highest yielding (4.3 t/ha) among the new varieties developed from Pool 16 DR and was also the earliest to flower among them. Across 87 Pool 16 SR BC6 was lower yielding than varieties extracted from Pool 16 DR but it is 1-2 days earlier in flowering and slightly shorter in stature. TZESRW-SE gave the lowest yield among all the varieties because like all floury maize, its weight per unit grain is lower than non-floury types.

As in the past two years, SAFITA-2 (the first variety extracted from Pool 16 by SAFGRAD) was out-performed by varieties from Pool 16 DR. It is therefore recommended that National Programs which had released SAFITA-2 to their farmers should consider replacing them with a variety from Pool 16 DR which in addition to higher yields is resistant to maize streak virus and more tolerant to drought than SAFITA-2.

RUVT Extra-Early

As in the past, TZEE-Y was the earliest entry (41 days to silk) but also the lowest yielding (2.8 t/ha). It flowered a week earlier than TZESR-W x Gua 314 which produced the highest yield (4.2 t/ha). CSP x Local Raytiri, CSP Early and TZEF-Y were 4 days later than TZEE-Y but 30-37% higher yielding. It is remarkable that TZEE-Y Pool is only 2 days later than TZEE-Y but 23% higher yielding.

RUVT Extra-Early trial was well appreciated in locations in Mali (Mansatola) and Tchad (Dougui and Gassi) where rainfall available to it was about 350 mm. Varieties that are later had no chance under such low rainfall circumstances.

3.2. Visits to National Programs

In order to monitor the Networks' activities and to promote interaction among NARS scientists, consultation visits were made to several countries by the Coordinator and members of the Steering Committee.

3.2.1. Visits by Network Coordinator

The Coordinator, Dr. J.M. Fajemisin, visited Guinea (10-17 July), The Gambia (18-22 July), Ghana (31 July to 4 August), Côte d'Ivoire (6-10 August), and Mali (21-25 August).

The major maize research stations visited in Guinea were Kilissi, Pita, and Kankan. There was a clear improvement of field-plot techniques compared to what was observed in 1988. In Pita, Mr. Abdoulaye Sow, one of the 1988 SAFGRAD Maize Network trainees, was firmly in control of maize research activities. At Kankan, maize research activity was very low, contrary to the level of interest in maize cultivation in that region. As a follow-up of last

year's consultation to Gambia on the development of a modest maize improvement program, Mr. Musa S. Mbenga, Agronomist/Breeder, was assisted in setting up (at Sapu) the half-sib improvement projects for the two widely cultivated maize cultivars : TZB yellow and Jeka. Some on-farm trials were visited and it was interesting to observe the great interest of the inhabitants of Sinchang Bajung village, where maize was more widely planted than any other crop.

The visit to Ghana was to discuss the setting up of streak screening facilities to which the Network has this year made some financial contribution. There was a protracted drought which affected the trials adversely. We took advantage of the drought incidence to select drought tolerant families in the Progeny Trial of Pool 16 DR planted at Nyankpala and whose flowering fell within the drought period.

Trials visited in Côte D'Ivoire included : RUVT-Early, RUVT Extra-Early, top cross evaluation, diallels involving yellow-grained cultivars, and evaluation and seed increase of local ecotypes. Useful discussion was held with Dr. Moyal, an out-going expatriate entomologist, on his findings on stem borers.

The trip to Mali involved visits to all the major maize testing stations in the south and center of the country namely : Sougoula, Kaboîla, Sotuba, Mansatolla and Katibougou. Streak infection was very high in Kaboîla. This station was described by the local agricultural officers as a "hot spot" for streak. Infection level was up to 55% on susceptible entries in a special trial of resistant and susceptible varieties planted there. The extra-early varieties showed clear advantages, particularly in Mansatolla and in Katibougou, where there were 19 days of drought and the plants were flowering in 42 days with a cumulative rainfall of 360 mm.

3.2.2. Visits by Members of the Steering Committee

Visits were made by Dr. Charles Thé of Cameroon to Benin Republic and Dr. Badu-Apraku to Togo.

Visit of Dr. Charles Thé to Benin Republic

The visit (September 21-25, 1990) was to allow Dr. Charles Thé to get acquainted with maize research activities in Benin Republic, participate in the on-going research and to make necessary suggestions for further improvement.

His visit concentrated on the northern parts of the country but he was accompanied by Mr. Yallou Chabi, the Benin Maize Coordinator based at Niaouli in the more humid south. He visited INA, the main research station in the north and two sub-stations, Bagou and Tchaourou. He evaluated the varieties in the various trials planted at these three stations, advised on the materials, and identified promising varieties/families/lines.

In Tchaourou, he observed a devastating attack of stem borers estimated to be about 95%. He discovered that in all the three maize trials established at this station, varieties extracted from the maize population TZSR-W-1 suffered the least damage by borers. The most damaged were EV 8443-SR, Okomasa, EV 8422-SR and hybrids 8321-18 and 8705-5 ; most of which are Tuxpeno-derived materials.

Dr. Thé was impressed by the conscientiouness of the maize technicians and the reliability of their data and good trial management in general.

Visit by Dr. Badu-Apraku

The main objective of the visit (August 21-25) was to enable him to study the streak screening facilities in Togo with a view to setting up similar facilities in Ghana. Another objective of the trip was to visit other maize research and associated projects in Togo. It may be noted that Togo is the first NARS in West and Central Africa to which the streak-screening technology has been sucessfully transferred from IITA.

Dr. Badu-Apraku was accompanied on the visit by Dr. Twumasi-Afriyie (another Ghanian maize breeder) and Dr. Owusu-Akyaw, an entomologist of the Ghana maize program. They visited Ativeme, Sotouboua, Broukou, Tatangashie, Tantiegou, and Toaga research stations.

At Ativeme, where the streak screening facilities were installed, they made very intensive observations and investigations. They took detailed notes on the structure of the screen house, methods of rearing the *Cicadulina* leaf hoppers and the infestation procedure. The Ghanian team was very impressed with the facilities in-place in Togo and decided to model the different types of cages being constructed in Ghana on those used in Togo. It is planned to evaluate the three most prevalent species of *Cicadulina* (C. *mbila*, C. *triangula* and C. *arachid)* to determine the most efficient vector for the streak virus in Ghana. Even though the transplanting of inoculated plants into the field has worked well for Togo, the Ghana maize program would like to adopt the IITA technique of inoculation, i.e. releasing viruliferous leaf hoppers into the whorls of maize plants in the field directly.

The team visited the nationally coordinated on-station and on-farm maize trials at several locations : Patatukou, Sotouboua, Broukou, Tantangashie, Tantiegou and Toaga. They found varieties AB11 and AB22 both developed by the national program to be very promising. AB11 was outstanding in terms of husk cover. They also visited seed production fields at Sotouboua.

SAFGRAD Trials (RUVT Early and RUVT Extra-Early) were observed at Broukou and Tantiegou. The promising entries in the RUVT Extra-Early were CSP x L. Raytiri ; TZESR-W x Gua 314 BC1 F3, Pop 30 x Gua 314 BC1 F3 but they found TZESR-W x Gua 314 BC1 F3 to be particularly impressive for good husk cover comparable to that of local varieties. In the RUVT-Early, Across 88 Pool 16 DR and EV 8731-SR BC6 were found promising.

3.3. MONITORING TOUR

3.3.1. Introduction

A monitoring Tour to Cameroon and Nigeria was undertaken 8-22 September, 1990 by selected members of the Network with the following objectives :

(i) to familiarize participants with the activities of the two countries, both of which are categorized by the network as Lead Centers for the implementation of some assigned research projects ;

(ii) to enable participants to gain experience on how maize research activities are linked with development agencies for the identification and resolution of maize production constraints in both countries;

(iii) to provide the national scientists an opportunity of visiting IITA and be intimated with its research strategies; and

(iv) to create a forum for interaction among national scientists and with international scientists for exchange of information and germplasm.

3.3.2. The Participants

With the exception of Guinea-Bissau, all the invited countries/institutions/organizations participated in the Monitoring Tour as follows :

Country/Institution	Name of participant	Discipline/Position
1. Cameroon	Charles Thé	Breeder
2. Central African Rep.	C. Ganglaou	Agronomist
3. Côte d'Ivoire	Koffi Attiey	Breeder
4. Gambia	Musa S. Mbenga	Agronomist/Breed
5. Ghana	G. Aflakpui	Agronomist
6. Mali	N. Coulibaly	Agronomist
7. Niger	Jika Naino	Breeder
8. Nigeria	K.A. Elemo	Agronomist
9. Maize Network	J.M. Fajemisin	Networ Coordinator and Pathologist/ Breeder
10. OAU/STRC	Taye Bezuneh	Director of Research
11. IITA (Maize Program)	S.K. Kim	Breeder
12. IITA (Maize Program)	J. Kling	Breeder

3.3.3. Visits to Cameroon and Nigeria

In Cameroon, the tour commenced from Nkolbisson Station where most of the maize genetic materials for evaluation in other lowland sites across the country are developed. The presence of considerable intensities of foliar diseases, including highland diseases like rust (Puccinia sorghi) and Helminthosporium turcicum blight can be positively exploited for selection of resistant genotypes.

In IRA/NCRE, Garoua, scientists were conducting agronomic and breeding research to address the increasing problem of Striga damage. Several experiments, comprising preliminary and advanced breeding generations and national and regional varietal trials, were being conducted to solve problems of interest to the Network. The SAFGRAD-sponsored trials on developing agronomic package for early and extra-early maturing varieties were located at several sites in northern Cameroon. The excellent working relationship between the researchers and SODECOTON explained the outstanding progress in the adoption of improved maize varieties and the increase of the area under maize in the Cameroon savannas. The trip to Maroua and environs revealed a close working relationship between sorghum and maize IRA/NCRE researchers. This was very clear with respect to Striga control strategy, on-farm testing, and field plot management.

In Nigeria, agronomic research at IAR/ABU on maize included developing management package for early and extra-early maize, intercropping and agroforestry. Participants also visited maize research activities of a privately managed seed compagny --Agricultural Seeds Ltd. The Agricultural Extension and Research Liaison Service of IAR/ABU was found to be well-equiped and farmer-oriented. The cultivation and utilization of several thousands of tons of maize for industrial purposes (such as brewery and bakery) in Nigeria was seen by the participants as a way of motivating and sustaining the interest of farmers.

The visit to National Seed Service (NSS) was well appreciated. NSS coordinates national seed multiplication, foundation seed production, seed certification, and seed testing.

3.3.4. Recommendations

The following recommendations/suggestions were made by the tour participants.

(i) Considering the tremendous amount of interaction with fellow scientists and the experiences gained within the 2-week period of the tour, the participants commended the idea of holding the tour and recommended that it should be a countinuing activity of the Network.

(ii) The participants appreciated the multi-disciplinary team approach of the Cameroon maize program and recommended that this philosophy be adopted and practised by all of the member-countries of the Network.

(iii) In appreciation of the large and diverse germplasm for various research goals being managed by the Cameroon Program, the team suggested that a second trained maize breeder be recruited and be stationed in the North.

(iv) The tour participants were impressed by the influence of the agronomic research at IAR/ABU on the expansion of maize in the Nigerian savannas (and indirectly in the neighboring countries), especially as all this has been done in close collaboration with the variety generating team based in the south of the country.

(v) The NARS scientists, in recognition of the leadership position of IITA maize program in the generation of adapted and streak resistant germplasm, recommended continuing international donor support to resolve the remaining major maize production constraints, especially Striga damage, and to develop suitable screening techniques for stem borers and storage insect pests.

(vi) Impressed by the good work of the National Seed Service of Nigeria, the participants recommended that neighboring countries take steps to obtain maximum benefit from the Nigerian experience.

3.4. TRAINING

In continuation of its efforts to alleviate the problems posed by inadequate trained maize technicians in the sub-region, the Network organized the third annual practical-oriented 5-month course at Kamboinse, Burkina Faso 18 June-23 November, 1990. Six technicians from the following countries participated : Benin, Burkina Faso, Cameroon, Gambia, Mali and Togo.

The training focused attention on field plot techniques, management of field experiments, varietal maintenance, seed production, agronomic practices including the use of tied ridges as a method of water conservation in the semi-arid zone and for simulating two systems of soil moisture for screening maize for drought tolerance, data processing, and interpretation of results. Each trainee managed two experiments from planting through data

collection, statistical analysis and data interpretation. Working visits were conducted to outstations at planting, during crop growth, and at harvesting to emphasize the importance of multi-locational field exprimentation.

3.5. FINANCIAL ASSISTANCE TO NATIONAL PROGRAMS

Eleven national programs were given financial assistance by the Network during the past year. They include both the Lead Centers and the technology-adapting NARS. In both cases, this was to supplement national budgetary allocations to the respective countries. Details of the allocations are given below:

1990/91 Allocation and disbursement of funds to Maize Network member-countries ($)

Countries	Amount allocated	Disbursement*	
		1st Instalmen	2nd Instalment
Benin	4000	2000	2000
Burkina Faso	3000	1500	1500
Cameroon	3000	1500	1500
Cent. Afr. Rep.	2000	1000	-
Chad	2000	1000	1000
Gambia	1000	1000	-
Ghana	3000	1500	1500
Guinea	2000	1000	-
Mali	3000	1500	1500
Nigeria	3000	1500	1500
Togo	3000	1500	-

* To ensure accountability, the second instalment is paid only if the first instalment is justified by the submission of appropriate receipts.

3.6. TECHNICAL BACKSTOPPING BY IITA

IITA provided effective backstopping to the Network. The participation of the Maize Program Director encouraged useful discussions on issues fundamental to the implementation of efficient maize research in the sub-region and to a harmonious relationship between NARS and IITA.

The program also contributed significantly to the success of both the Monitoring Tour and the Workshop. The provision of germplasm is also a well acknowledged assistance received from IITA by the Network member-countries.

IV. HARMONIZATION OF SAFGRAD AND CORAF MAIZE NETWORKS

In pursuance of the attempts to harmonize the activities of the Maize Networks coordinated by SAFGRAD and CORAF, a meeting was held at Ouagadougou, Burkina Faso, May 7-8, 1990. Participants comprised three members from each Network, constituting the Harmonization Committee and of observers from IITA and SAFGRAD Coordination Office. The Committee reviewed the areas of emphasis of each Network in relation to the major constraints to maize production in West and Central Africa. It would be recalled that in previous meetings on this matter, it was agreed that the mandate of SAFGRAD remains the semi-arid ecology (Northern Guinea and Sudan savannas with rainfall not less than 400 mm) and that for CORAF being the humid and sub-humid ecologies and for irrigated culture in areas with less than 400 mm rainfall. The Harmonization Committee discussed on the mode of approach and the calendar of major events (meetings, workshops, monitoring tours, etc) of each network in order to avoid duplication and conflict.

Recognizing the problems posed by the existence of the CORAF and SAFGRAD Networks within the same sub-region and in an atmosphere of acute shortage of trained manpower, the members of the Harmonization Committee recommended that the two networks should be merged to form one network, with one Steering Committee, within the next two years. It also recommended that the two executive bodies of the respective networks should meet to expedite the implementation of the recommendation on merging.

V. UP-DATE ON VARIETY RELEASE

The varieties of the Network have accelerated the release of improved maize varieties in the sub-region. The names of varieties released in countries of West and Central Africa through the instance of the Network are listed in the following table.

Maize Varieties identified for release by countries in West and Central Africa through SAFGRAD Network.

Country	Name of varieties	Origin	%total maize area	Remarks
Benin	TZB and TZB-SR	IITA	25	
	Poza Rica 7843-SR	CIMMY/IITA	10	
	TZSR-W	IITA	5	
	TZESR-W	IITA	5	
	Pirsaback 7930-SR	CIMMY/IITA	3	
	DMR-ESRW	IITA	-	Recently released
	Across 86 Pool 16 DR	SAFGRAD/IITA	-	On-farm trials
Burkina Faso	EV 8422-SR	CIMMY/IITA	60	
	SAFITA-2	SAFGRAD/IITA	5	
	KPB (TZESR-W)	IITA	3	
	KPJ (EV 8431-SR)	CIMMY/IITA	-	On-farm trial
	Pool 16 DR	SAFGRAD/IITA	-	"
	KEB (Kito)	SAFGRAD/IITA	-	"
	KEJ (CSP Early)	SAFGRAD/IITA	-	"
	TZEF-Y	SAFGRAD/IITA	-	"
Cameroon	TZB/TZB-SR	IITA	15	
	CMS 8806 (DMR-ESRY)	IITA	-	On-farm trials
	Pool 16 DR	SAFGRAD/IITA	-	"
Cape Verde	Maka	SAFGRAD/Mauritania	-	On-farm trials
Cent. Afr. Rep	CMS 8710	Cameroon/SAFGRAD	-	On -farm trials
	CMS 8501	Cameroon	-	"
Côte D'Ivoire	TZSR-Y	IITA	-	
	Pool 16 DR	SAFGRAD/IITA	-	On-farm trials
	TZEF-Y	SAFGRAD/IITA	-	"
	Maka	SAFGRAD/IITA	-	"
Ghana	Okomasa/Dobidi (Pop 43)	CIMMYT/IITA	35	
	Aburotia/Abelcehi (P0p 49)	"	15	
	SAFITA-2	SAFGRAD/IIT	2	
	Dorke-SR (Pool 16 SR)	IITA	-	Recently released
	GH 8363-SR(QPM)	CIMMYT	-	Just released

Country	Name of varieties	Origin	%total maize area	Remarks
Guinea	Ikenne 83 TZSR-Y-1	IITA	-	On-farm trials
	EV	CIMMY/IITA	-	"
Mali	TZESR-W	IITA	10	
	SAFITA-2	SAFGRAD/IITA	3	
	DMR-ESRY	IITA	-	On-farm trials
	TZEF-Y	SAFGRAD/IITA	-	"
Mauritania	Maka	Mauritania/SAFGRAD	35	
	Capinopolis 8245	CIMMYT/SAFGRAD	10	
	Pool 16 DR	SAFGRAD/IITA	-	On-farm trials
Niger	EV 8431-SR	IITA/SAFGRAD	1	
	TZESR-W	IITA	0.5	
	EV 8435-SR	IITA/SAFGRAD	0.5	
	Jaune Flint de Saria	Burkina/SAFGRAD	2	
	Maka	SAFGRAD/Mauritania	0.5	
Senegal	Pool 16 DR	SAFGRAD/IITA	5	
	Maka	SAFGRAD/Mauritania	5	
	Ikenne (1) 8149 SR	CIMMYT/IITA	-	On-farm trials
Tchad	TZESR-W	IITA	-	No statistics
	CMS 8501	Cameroon	-	On-farm trials
	Pool 16 DR	SAFGRAD/IITA		"
	CMS 8602	Cameroon		"
Togo	Ikenne 8149 SR	CIMMYT/IITA	6	
	EV 8443-SR	CIMMYT/IITA	6	

SECTION B

COWPEA NETWORK ANNUAL REPORT 1990/91

1. COLLABORATING NATIONAL PROGRAMS AND NATIONAL COWPEA COORDINATORS

Having assembled resources and personnel together in 1987 to tackle common problems in order to attain sustainable cowpea production and productivity in West and Central Africa, cowpea scientists, through its Steering Committee endorsed the idea of networking as a way of strengthening their research efforts. It became necessary, therefore, to assess the strength and weakness of the individual national programs and to determine their willingness to exchange scientific information and newly developed technologies among themselves. For an effective implementation of these activities, member countries were classified and countries that had relatively strong national research capabilities were entrusted the role of "Lead Center". "Technology Adopting" being the responsibility of each member country. In 1989, the role of Associate Research Centers was added.

1.1. LEAD CENTERS

In addition to Ghana a total of six national programs were assigned by the Steering Committee the responsibilities of conducting technology development research activities of interest to their national programs and the network as a whole.

1. Burkina Faso - Research activities: Breeding for drought, Striga, insect pests and disease resistance; Entomology, Pathology.
   - National Coordinator: Dr. Dabire Clementine
     (Entomologist) INERA,
     01, BP 476
     Ouagadougou 01.
2. Cameroon - Research activities : Entomology with particular emphasis on storage insect pests control.
   - National Coordinator: Mr. Ntoukam Georges

(Entomologist)
From April 1 to December 31, 1990
Mr. Chevalier Endondo
(Agronomist)
From January 1, 1991.
IRA, BP 33, Maroua.

3. Ghana - Research activities: Breeding for coastal, sub-humid, transition and northern Guinea zones; cowpea entomology including storage; and agronomy. Adaptation studies for Striga resistance in Sudan savanna zone.
- National Coordinators: Mr. G.A. Amankwa (Breeder) for coastal, sub-humid and transition zone.
C.R.I.
P O Box 3785, Kumasi.
Dr. K.O. Marfo (Breeder) for savanna zone.
P O Box 52, Nyankpala.

4. Niger - Research activities: Breeding for drought, *Striga*, insect pests and dusease (*Macrophomina* spp.) resistance; Agronomy Pathology, including *Striga*.
- National Coordinator: Mr. Moutari Adamou (Breeder)
INRAN, BP 429, Niamey.

5. Nigeria - Research activities: Breeding for drought, Striga, insect pests and disease resistance; Agronomy, Pathology. Entomology.
- National Coordinator: Dr. O.O. Olufajo (Agronomist)
Department of agronomy
IAR/ABU, PMB 1044, Zaria.

6. Senegal
   - Research activities: Breeding for drought, insect pests and disease resistance; Entomology.
   - National Coordinator: Mr. Cisse Ndiaga
     (Breeder)
     ISRA/CNRA
     BP 53, Bambey.

1.2. ASSOCIATE RESEARCH CENTERS:

Associate Research Centers are selected from national programs other than Lead Centers found to possess ressonably sufficient skilled manpower and average research infrastructure. They conduct technology development research work for their own interest. In addition, they play an important role in the multilocation testing program (validation of technologies with regards to adaptation, diseases, insect pests and *Striga* resistance) of new technologies developed by RENACO Lead Centers and/ or IITA-GLIP.

Associate Research Centers were created in 1989 by the Steering Committee as follows:

1. Benin
   - Research activities: Breeding and adaptation work for coastal, sub-humid, transition and Guinea savanna with particular emphasis on resistance to insect pests, diseases and *Striga*.
   - National Coordinator: Dr. J. Detongnon
     (Breeder)
     SRCV-Niaouli
     BP 3, ATTOGON.

2. Mali
   - Research activities: Breeding and adaptation work for northern Guinea and Sudan savanna and the Sahel with particular emphasis on resistance to insect pests, diseases and *Striga*.
   - National Coordinator: Mr. Kodio Ondie

(Breeder)
from April 1 to June 30.
Mr. Aliou Traore
(Breeder)
from July 1, 1990
IER/DRA/SRCVO
BP 438, Bamako.

1.3. **TECHNOLOGY ADOPTING CENTERS:**

1. Cape Verde - Mr. C.E.P Silva (Agronomist)
INIA/MDRP. BP 50, Praia

2. Côte d'Ivoire - Mr. Adou Amalaman (Agronomist)
Institut des Savanes
BP 635, Bouake 01.

3. The Gambia - Mr. Musa Bojang (Agronomist)
Dept. of Agric. Research
West Division, Yundum

4. Guinea Bissau - Mr. Abu Biai (Agronomist)
M.D.R.E. Agricultural
C.P. 71, Bissau-DEPA/CENEMAC
Contuboel

5. Guinea Conakry - Mr. F.L. Guilavogui (Entomologist)
Institut de Recherches Agronomiques
de Guinée (IRAG), BP 1003,
Conaky.

6. Mauritania - Mr. Sidi R'Chid (Agronomist)
CNRADA, BP 22, Kaedi.

7. Togo - Mrs. Akossiwa Duyiboe (Agronomist)
DRA, BP 2318, Lome.

II. MANAGEMENT OF THE COWPEA NETWORK

The 8th and 9th meetings of the Steering Committee of RENACO were held within the period April 1, 1990 and March 31, 1991.

2.1. THE EIGHTH STEERING COMMITTEE MEETING:

The 8th Steering Committee meeting was held at Cotonou, Benin, November 5-9, 1990. The opening ceremony of the meeting was chaired by Dr. E.B. Assan, the Director of Agricultural Research of Benin Republic.

a) **In attendance were:**

- **Members of the Steering Committee**

Dr. J. Detongnon	(Benin)	-- Chairman
Dr. O.O. Olufajo	(Nigeria)	-- English Secretary
Mr. G. Ntoukam	(Cameroon)	-- Ag. French Secretary
Mr. Ndiaga Cisse	(Senegal)	
Mrs. C. Dabire	(Burkina Faso)	
Mr. G.A. Amankwa	(Ghana)	
Dr. N. Muleba	(Network Coordinator)	

- **Observers and Resource Persons**

Dr. T. Bezuneh	(Director of Research, SAFGRAD)
Dr. S.R. Singh	(Director, IITA-GLIP, Ibadan, Nigeria)
Dr. B.B. Singh	(IITA-GLIP Kano, Nigeria, Sub-station)
Dr. J.C. Sentz	(IITA-USAID Liaison Officer, Ibadan, Nigeria)
Mr. E.F. Deganus	(Coordinator of Special Projects, IITA-ICP, Ibadan, Nigeria)
Dr. S.T.O. Lagoke	(Coordinator, Pan-African *Striga* Network, Zaria, Nigeria)
Dr. B.R. Ntare	(IITA-GLIP, Sadore/Niamey, Niger Sub-Station)

(b) **Agenda of the meeting**

The following RENACO activities were discussed:

(1) **General matters:**
- Adoption of the proceedings of the 7th meeting of the Steering Committee, held at Ouagadougou, Burkina Faso, 26-30 March,1990.
- Matters arising from the minutes of the 7th meeting of the Steering Committee.

(2) **RENACO activities**
- Mid-year report of RENACO
- 1990 cowpea monitoring tour
- Visits to Central African Republic and Tchad
- Visits to the Gambia and Cape Verde.

(3) **SAFGRAD-II: Proposal for extension**

(4) **Miscellaneous matters**

- Nomination of varieties for 1991-92 regional trials.
- Pan- African Striga control

(c) **Highlights of the deliberations:**

The following were noted by the Steering Committee:

- The overall good impression of the participants of the 1990 cowpea monitoring tour:
- The redeployment of IITA-GLIP research efforts to cover all the major ecological zones of cowpea growing areas of West and Central Africa in order to effectively alleviate cowpea production constrainsts and to better serve national programs.

- The Steering Committee was in agreement with the participants of the tour of the need for a full-time cowpea research agronomist to be assigned by the Burkinabe authorities to their national cowpea research program and;

- A Pathologist and an entomologist to be assigned by IITA authorities to the GLIP-IITA Kano sub-station in northern Nigeria.

- The Steering Committee also noted with deep concern the decision taken by IITA to close down the GLIP-IITA Sadore sub-station in Niger. In view of the importance of cowpea after millet in Niger, and the fact that the closure of the GLIP-IITA Sadore sub-station might weaken Niger's national cowpea program, particularly that it is a Lead Center of RENACO, the Steering Committee requested that efforts be made by SAFGRAD authorities to address the issue.

The extension proposal for SAFGRAD-II was discussed. The proposal covered a 13 month period from September 1, 1991 to September 31, 1992. Budget line items to be funded have been prepared accordingly.

(d) Recommendations:

The cowpea research network Steering Committee adopted the following recommendations:

(1) Considering that the visit of members of the Steering Committee to RENACO member countries is a step in the right direction it is recommended that there should be a follow-up to these visits in order to derive maximum benefits from the contacts already established.

(2) Anxious to provide quick solutions to common problems of cowpea production in the sub-region; it is recommended that working groups be formed in the following specific areas; breeding, agronomy, entomology and pathology including *Striga*.

(3) Recognizing that a lot of achievements have been made through the network activities but have neither been properly documented nor quantified; it is recommended that the Network Coordinator should write to national programs to provide a list of varieties that have been released and those that are about to be released and if possible, provide approximate acreage of production.

(4) Considering the fact that cowpea is a very important crop in the Sahelian zone; the Committee recommends that IITA should continue its activities in this zone in collaboration with ICRISAT through the Sadore Station.

2.2 THE NINTH STEERING COMMITTEE MEETING

The above-cited Steering Committee meeting was held at Niamey, Niger, 13-14 March, 1991, concurrently with the joint maize-cowpea-sorghum networks workshop.

(a) **Attendance**

- **Members of the Steering Committee**

Dr. O. O. Olufajo	(Nigeria)	-- Chairman
Dr. C. Dabire (Mrs).	(Burkina Faso)	
Mr. F. L. Guilavogui	(Guinea Conakry)	
Mr. M. Gumedzoe	(Togo)	
Mr. H. Hassane	(Niger)	-- French Secretary
Dr. K. O. Marfo	(Ghana)	-- English Secretary

- Observers and resource persons:
  Dr. B. B. Singh, Cowpea Breeder, IITA-GLIP-Kano
  Nigeria, representing the Director,
  IITA-GLIP.
  Dr. S. Koala, Regional Coordinator, IDRC (Canada),
  Dakar, Senegal.

(b) **Agenda of the meeting:**

The following RENACO activities were discussed:

(1) **General matters:**

- Election of the Chairman and Secretaries of the Steering Committee for the 1991-92 period.

- Adoption of the proceedings of the 8th meeting of the cowpea Steering Committee held in November 1990 at Cotonou, Benin.

(2) **RENACO Activities:**

- Regional trials: formulation of the 1991-92 regional trials.
- Observation nurseries for the 1991-92 period.
- Assessment of Lead and Associate Centers.
- Assessment of technology adapting centers.
- Assessment of the 1991-92 research workplans of Lead and Associate Centers.

- Visits to national programs during the 1991 crop season.
- Financial support to national programs (Lead and Associate Centers and Technology Adaptinhg Centers).

(3) **Miscellaneous matters:**

- SAFGRAD II: Proposal for extension.
- RENACO working groups for breeding, entomology, agronomy and pathology including Striga.
- Other related matters.

(c) **Highlights of the deliberations:**

- The Steering Committee (SC) was satisfied with the performance of all Lead and Associate Centers and recommended that they continue work on their assigned research topics for the next two years. However, for Senegal, the SC requested for it to be relieved from its responsibility in entomology due to lack of qualified personnel in this area. Whereas for Benin and Cameroon, the SC decided that a visit to each country be made to assess research facilities and staff situation before they can be advised whether or not they can continue work on the RENACO assigned responsibilities.
- From data presented by RENACO Lead and Associate Centers and GLIP-IITA scientists, four regional trials and one observation nursery made up of 66 sets of trials were requested by member countries:
  (i) Adaptation to transition zones.
  (ii) Adaptation to Sahelian and Sudanian zones.
  (iii) Adaptation to Northern Guinea savanna zones and
  (iv) *Striga* resistance. An observation nursery was also designed and included.
- Working groups in cowpea breeding, entomology, pathology including *Striga* and agronomy were initiated in the hope that during SAFGRAD III they would have prepared themselves well enough to efficiently carry out their research activities. They will have, thus, opportunities to discuss common cowpea

production constraints, research methodologies and see how best they can effectively tackle and solve such constraints.

(d) **Recommendations:**

1. Judging from the number and quality of scientific papers presented at the workshop, and the great interaction between the networks, it is recommended that the biennial inter-networks workshop should be encouraged.

2. The network noted with satisfaction the research output on cowpea by the various national programs as demonstrated by the presentation at this workshop. It is recommended that SAFGRAD should continue to support and encourage national programes through networking.

3. The network noted the strong need for higher degree and in-service training. It is recommended that higher degree training should be included in the next phase of SAFGRAD.

4. Considering the devastating effects of parasitic flowering plants on cowpea in the subregion, the network recommends that research should be intensified on Striga and Alectra.

5. The network considers the formation of working groups as a step in the right direction. It is recommended that necessary support should be provided to the groups in order to facilitate the provision of solutions to common problems of cowpea production in the sub-region.

6. In view of the facts that cowpea is a very important crop in the Sahelian zone, the network wishes to re-emphazise the need for IITA to continue its research activities on cowpea in this zone in collaboration with ICRISAT through the Sadore station.

III. STRENGTHENING NATIONAL PROGRAMS

Efforts made to strengthen national programs involved the following activities.

3.1. COLLABORATIVE RESEARCH

Collaborative research activities in 1990 were carried out by the 6 RENACO Lead and 2 Associate Centers according to research responsibilities assigned to them by the Steering Committee. With the exception of Cameroon and Senegal, annual progress reports of the above-cited centers were presented and discussed during the joint maize-cowpea-sorghum networks workshop held at Niamey, Niger, 8-14 March 1991. Reports from Cameroon and Senegal were made available with apologies to the Network Coordinator at a later date.

BURKINA FASO

(a) **Breeding:**

Breeding nurseries: 17 crosses were made during the 1990-91 crop season. They included 1 cross for bruchid resistance; 2 for aphids resistance; 8 for Striga resistance; one combining resistance to aphids, bruchids and Striga; and one cross for scab (Elsinoe phaseoli) resistance. The crosses (100 plants each) were advanced to F2 in wooden boxes near the screenhouse at Kamboinse during the 1990 crop season. Each population was subjected to selection against naturally occurring fungal, bacterial and viral diseases.

Three F4 populations (KVx403, KVx404 and KVx414) were advanced to F5 by subjecting them to selection for adaptation and against naturally occuring fungal, bacterial and viral diseases as well as insect pests. In order to attain this goal, they were sown at two differant dates under protection against insect pests, and one sowing date (optimal sowing date) without protection against insect pests at four locations: Pobe, in the Sahel; Kamboinse, in Sudan-savanna; and Farako-Bâ and Nyangoloko, in the Northern Guinea savanna. Only disease-free, high yielding plants with good growth habits were mass-selected for each treatment. Each population (F5) was reconstituted by mixing 1/3 of seed selected from the first and second sowing dates (50% each) under insect pest protection and 2/3 of seed selected, under no-insect protection.

Preliminary yield trials

. Fifteen entries, 10 of which were lines from crossess involving the *Striga* resistant varieties B301 and SUVITA-2 (including its best derivative lines), were yield tested at three locations: Pobe, Kamboinse and Farako-Bâ, using two sowing dates under protection against insect pests and one sowing date (optimum sowing date) without insect pest protection at each location. They were scored for resistance to naturally occurring diseases in each enviroment. A combined analysis, taking into account locations, sowing dates, insect pests protection showed lines KVx402-5-2, KVx402-19-1 and KVx402-19-5 to be the most promising They were the best adapted and highest yielding under the different testing conditions. Other lines and cultivars of interest were: KXx397-6-6, KVx397-9-11, for the Sahel; KVx397-6-6, KVx398-29-2 and TN121-80-7, for Sudan savanna; and KVx397-9-11 and KVx398-29-2, for northern Guinea savanna.

Another set of 15 entries, of which 13 lines, combining resistance to aphids, bruchids and Striga, were tested at Pobe, Kamboinse and Farako-Bâ. The experimental design was the same as described in the above-cited experiments. The best promising lines across locations, sowing dates and insect pest protection treatments were:KVx164-41-64, KVx291-47-222 and KVx295-2-124-51. Other lines of interest were KVx305-2-118-23-2, KVx293-114-13 and KVx305-2-118-23-1, for the Sahel; KVx305-2-118-23-2 and KVx305-118-32, for Sudan savanna; and KVx305-118-31 for northern Guinea savanna.

Advanced yield trials: Seven promising lines and one commercial check (for each location) were tested at four locations: Pobe, Kamboinse, Farako-Bâ and Nyangoloko. They were planted in pure-stand and intercropped with cereals with and without insect pest protection for each cropping system at each location. Line KXx396-4-5-2D performed best at each location under each growing condition. Its yield was, however, reduced signigicantly under no-insect pest protection in pure-stand cropping system. Although not as high yielding as KVx396-4-5-2D, KVx165-14-1 distinguished itself clearly in that its yield was not statistically affected by insect pest protection treatments exhibiting thus, insect pest resistance or tolerance. Other lines of interest were IT85D-3516-2 and KVx396-18-10 in the Sudan and northern Guinea savanna zones.

Evaluation of dual purpose cowpea: Twelve entries of which 7 lines were from GLIP-IITA Ibadan, 4 from IAR in northern Nigeria and one commercial check (for each location) were tested at two locations: Pobe and Kamboinse. They were sown at the optimum date in pure-stand cropping under insect pest protection (two sprays). The most promising lines for both grain and fodder yields across locations were: IT86D-714, IT86D-3428-4, IAR7/180-4-5 and IAR7/180-4-5-1.

(b) **Entomology:**

- **Aphids (Aphis craccivora) population dynamics:** This is an on-going study. Aphids attack cowpea at the early stage of the crop season. In 1990, aphids emerged throughout the month of August and declined in early to mid-September and became less important thereafter to early November when they virtually disappeared.

- **Thrips (Megalurothrips sjostedti) population dynamics.** In contrast with aphids, thrips emerge towards the end of the season. In 1990 their population was very severe in early August, just before cowpea flowering. About 20 insects per container per week were captured. Towards mid-August, an alarming increase (60 insects per conatainer per week in mid- September) was observed, building up to 200 insects a week per container at the end of October. At plant maturity, thrips population was observed to have declined considerably in early November. It appears, therefore, that since local varieties flower in September and October, they are either resistant or tolerant to thrips. In order to avoid thrips damage, cowpea should be planted so as to flower in early August, although they will be subjected to pod and seed rot because of the usual heavy rainfall at this period.

- **Host plant resistance:** Lines evaluated in the preliminary yield tests, were studied for their resistance to naturally occurring insect pest infestation at Pobe, Kamboinse and Farako-Bâ.

. **Cowpea field resistance to Aphids**

.. Pobe: There was no aphids infestation at this Sahelian location in 1990, just as in 1989.

.. Kamboinse: At this Sudanian location, entries in the group of KVx397 through KVx402 lines, were all infested with aphids, although at a moderate level.

The most promising line and cultivar were respectively KVx402-19-2 and TN93-80-6. For the set of KVx164 through KVx305, the most resistant lines were: KVx295-2-124-51, KVx293-114-13 and KVx295-2-124-52. The common check TVx3236 was highly susceptible to aphids in both trials.

.. Farako-Bâ: At this northern Guinea savanna site, the level of aphids infestation was higher than at Kamboinse and there was no statistical difference among entries in both sets of experiments. However, for the set of KVx397 through KVx402, lines KVx402-19-2- and TN93-80-6 had the lowest score of infestation suggesting that their resistance observed at Kamboinse is also effective at Farako-Bâ.

. **Cowpea field resistance to thrips:** In both preliminary yield trials, thrips population was higher at Kamboinse (23 thrips/flower) than at Pobe (10-17 thrips/flower) and Farako-Bâ (14 thrips/flower). The least thrips infested cultivars and lines across locations were: TVx3236, KVx293-114-13 and KVx164-65-5. It should, however, be pointed out that, in spite of high thrips pressure at Kamboinse, in the Sudan savanna zone, lines KVx397-9-11, KVx398-7-1 and KVx401-31-1 had the lowest thrips infestation at that location.

- **Effect of cowpea plant population density on natural insect pest infestation:** The experiment was started in 1989. It involved three cultivars, one local and two improved ones. Unlike in 1989, it was conducted at two sites in 1990: on-station (bottomland field) and on-farm (upland field). Entries used in 1990 were a farmer's variety KVx165-14-1 and KVx396-18-10.

From the 1989 and 1990 results, it appears that low plant populations or wide spacing enabled cowpea plants to grow more vigorously and resisted insect damage better than high plant populations. Yields as high as 200 kg/ha can be obtained with currently improved cultivars without insect protection.

- Insecticide evaluation: The following products were tested: neem (Azadirachta indica) cake infusion (two levels 50 and 100g/litter of water), a local product, Karate ED, Cyfluthion, Serimol, Phenthoate, Reldan 50 EC, and Decis + Dimethoate were tested against an unsprayed check to study their effect in suppressing aphids, thrips, Maruca and pod sucking bugs. Lambda Cyhalothrine (Karate ED) and Deltamethrine (Decis) controlled effectively the population of thrips, Maruca and pod sucking bugs. The addition of the systemic insecticide "Dimethoate" to Decis, did not improve the efficacity of the mixture in controlling insect pests as observed in previous years. Since, the neem cake infusion gave good results, it will be tested again next year.

(c) **Pathology:**

- **Survey of cowpea fungal diseases:** Twenty samples involving 7 improved and 4 local varieties were taken from 6 experiment stations and sub-stations (Farako-Bâ, Kamboinse, Kouare, Di, Saria and Pobe) to study the naturally occurring seed transmitted fungal diseases. Of the 12 fungi investigated, only *Fusarium equiseti, F. semitectum* and *F. graminearum* did not induce diseases on cowpea. *Colletotrichum capsici* and *Macrophomina phaseolina* induced severe diseases on cowpea and can result into an epidemic under certain conditions. Cultivar differences in seed borne diseases were observed. Seed treatment with fungicide Benlate T20 was effective in controlling seed borne diseases except for *C. capsici* and *M. phaseolina* in certain cultivars, IT81D-994 and KVu69. It is, therefore, recommended not to use a seed lot containing more than 20% contamination and to treat seeds with an effective fungicide such as Benlate T20 before planting.

- **Importance of "brown blotch" (C. capsici) disease:** C. capsici was found in 5 of the 6 stations studied. the infection was higher at Farako-Bâ than Kamboinse and Pobe. Local varieties were less infected than improved cultivars. Among the latter cultivars TVx3236 at Farako-Bâ, Kamboinse and Pobe and KN-1 at Di were less infected than the others.

- **Evaluation of yield losses induced by brown blotch diseases:** The study was conducted at two locations: Farako-Bâ and Kamboinse with three cultivars and five levels of disease control, using fungicide Benlate T20. To ensure disease infection, spreader rows were sown ten days earlier than the test plots. The disease incidence was higher at Farako-Bâ than at Kamboinse. Cultivars KVx61-1 was highly susceptible to the disease at both locations; KVu69 was intermediate and KVx396-4-4 was less susceptible than KVu69. Cultivar KVx61-1 gave good yield only under brown blotch disease protection with Benlate T20.

(d) **Striga control studies:**

- **Evaluation of local and introduced germplasm for Striga resistance:** Six landrace varieties and cultivars from Niger, and two landrace varieties from Burkina Faso were evaluated for *Striga* resistance in a *Striga* sick plot at Kamboinse. *Striga* shoots emerged in all the plots. However, cultivars TN27-80, from Niger, and KVx396-16-10-1, from Burkina Faso, induced the death of all *Striga* shoots before flowering or setting up of capsules. For Sadore local, from Niger, 90% of Striga shoots from its plot were parasitized by the insect *Smicronix* sp..

- **Preliminary yield test in a *Striga* sick plot**:

  Fifteen entries of which 10 lines involved B3O1 crosses were evaluated in a *Striga* sick plot at Kamboinse. Based on *Striga* emergence date, *Striga* density and Striga dry weight, the following entries were found to be *Striga* resistant: KVx397-6-6, KVx397-9-11, KVx398-7-1, KVx4O2-5-2, KVx4O2-19-1, KVx4O2-19-5, TN121-8O-7 and B3O1. KVx4O2-5-2 gave the highest yield. With the exception of KVx4O2-19-1 and B3O1, all resistant entries gave good yield.

  Fifteen entries of which 13 combined resistance to *Striga*, aphids and/or bruchids were yield-tested in a *Striga* sick plot at Kamboinse. The following lines were found to be resistant: KVx164-65-5, KVx164-41-64, KVx295-2-124-52, KVx295-2-124-121 and KVx3O5-118-31. Their yields were not, however, significantly different from that of SUVITA-2.

- **Advanced yield trial in a *Striga* sick plot**: Nine entries from IITA-Ibadan (4), Senegal (1), Niger (2) and Burkina Faso (2) were evaluated in a *Striga* sick plot at Kamboinse and Fada N'Gourma in the Sudan savanna zone.

  .. IT81D-994 and TN121-8O-7 were *Striga* resistant at both locations, confirming thus, the 1989 observations. Also resistant in 199O at both locations was TN93-8O-6.

  .. IS86-275N, IT87F-1738-4, IT86D-257 and KVx396-18-1O were *Striga* tolerant (i.e., they gave high yield in spite of heavy *Striga* infestation).

- **Effect of solarisation and nitrogen on *Striga* control**: The objective of the trial was to study the effect of solarisation and nitrogen rates on cowpea performance under *Striga* infestation. Two solarisation treatments (viz. transparent polyethelene sheet laid on a field plot versus a bare soil field plot) and three nitrogen rates (0, 15 and 30 kg of N/ha as urea) were tested in a *Striga* sick plot using a *Striga* susceptible cultivar IT82E-32. A transparent polyethelene sheet allows short wave length (<760 nm) solar radiation to pass through and retains long wave lengths (>780 nm) radiation. As a result, temperature increases in between the covered soil and the plastic sheet. Lethal temperatures (45-50°C) are expected to sterilize the soil (including the killing of *Striga* seeds). A soil temperature wave is expected to be transmitted from top soil to subsoil within 24 hours. The plastic sheets were used in May 1990, a sunny and hot period.

  Solarisation significantly delayed *Striga* emergence, density and dry weight. (*Striga* dry weight was more than 10 times greater in untreated than in solarized plots). However, there was no significant effect on cowpea seed yields. Nitrogen rates had no significant effect on *Striga* emergence, density and dry weight. They, in contrast to solarisation treatments, significantly affected cowpea grain yields, which increased with the rates. Solarisation was, thus, effective in sterilizing of *Striga* infested plots.

e) Agronomy

- Soil and water management: Four cowpea cultivars were tested at three levels of soil water management (sowing on flat, sowing on flat converted to tied ridges three weeks after sowing and sowing on tied ridges) in Alfisol at Kamboinse. The objective of the trial was to compare the performance of promising line KVx396-4-4 with a farmer's variety (Koakin local) and two commercially released cultivars KN-1 and TVx3236. Cowpea yield increased significantly with the early ridging and tied ridges. Unlike the best commercially released cultivar TVx3236, which did not differ significantly from the farmer's variety (Kaokin local), KVx396-4-4 yielded equally and significantly higher than the latter, respectively, under low and high levels of soil water management.

- Effects of wind-break and mulching on cowpea in the Sahel: The promising line KVx396-4-4 was tested against drought resistant cultivar TN88-63, drought susceptible cultivar IT82E-32 and a farmer's variety: Pobe local, using two wind-break treatments (with and without wind-break) and two mulching treatments (with and without mulching). The experiment was established at Pobe/Djibo in the Sahel. On the average, protection of cowpea crops against dominant wind increased cowpea yield by 7%; whereas, mulching increased cowpea yield by 5%. The new line KVx396-4-4 was the highest or among the high yielding cultivars at all treatments. Its yield increased in the combination: no-wind-break with mulching and declined in the combination: wind-break with mulching. It outyielded TN88-63 only under the no wind-break treatment. TN88-63 which outyielded the drought susceptible cultivar IT82E-32 at all treatments, exhibited, however, a similar response with the latter. Their yield increased with the wind-break and mulching treatments. The farmer's variety, Pobe local,performed poorly at all treatments, probably, because of its long growth duration which exposed it to the severe end of season drought.

- Effect of cowpea cultivars and spacings on the performance of cereal in intercropping systems: The new line KVx396-4-4 was tested against TVx3236 and a farmer's variety at three spacings (20 x 160 cm, 60 x 160 cm and 100 x 160 cm). The spatial arrangement consisted of 2 cereal rows to one cowpea row. The space between rows was 80 cm. The experiment was established at Pobe, in the Sahel; Kamboinse and Fada N'Gourma in the Sudan savanna; and Farako-Bâ, in the northern Guinea savanna. Cereals and cowpea were sown at the same time at all locations, except at Farako-Bâ, where cowpea was sown three weeks after the cereals. The cowpea inter-row spacings, 20 cm, gave the highest yield at all locations, but did not differ significantly with the 60 cm spacing. The best intercrop performance (combined yield of cereals and cowpea) was obtained from the 60 cm inter-row spacing. With the exception of the Kamboinse location, where the local variety (Sakoula local) gave the highest yield, KVx396-4-4 significantly out-yielded other cultivars and varieties at all locations.

CAMEROON

Owing to the change in leadership of the national cowpea program of Cameroon (departure on Ph.D study leave of Mr. G. Ntoukam and his replacement by Mr. C. Endondo) at the beginning of 1991, no Cameroonian representative for cowpea program attended the Niamey workshop. Nevertheless, the report was later on made available to the Network Coordinator and is summarized as follows: Cameroon benefits from assistance based on a bilateral agreement with the U.S. Bean/CRSP project; it accepted leadership for the RENACO cowpea storage and conducted research in 1990 in the areas of cowpea improvement and storage.

a) **Cowpea improvement**:

- **Farmers' surveys**: Farmers' surveys were conducted by interviewing farmers in 17 villages in 2 major cowpea growing zones in northern Cameroon. The objectives of the surveys were: (i) to observe and discuss cowpea growing practices and preference of farmers and (ii) to systematically record their reactions to the detailed questionnaire.

The results are as follows:

. Acreage: 0.62 ha (range: 1/8-3 ha) per household;
. Pure stand cropping: 38%
. Mixed cropping: 62%
. Proportion of local varieties: 81%
. Proportion of improved varieties: 25%
. Proportion of pure stand cropping with improved cultivars: 97%
. Proportion of mixed cropping with local varieties: 3%
. Average yield: 250kg/ha (range: 10-80 kg/ha).
. Source of seeds used by farmers:
  + Market 48%
  + Farmer's own stock 28%
  + Extension service (IRA/ SODECOTON) 17%
  + Church Missionaries 4%
  + Other farmers 2%
. Proportion of farmers using insecticides 34%
. Production constrainsts:
  + Field insect pests 76%
  + Storage insect pests 62%
  + Striga 6%
  + Drought 7%
  + Availability of improved seeds 5%

. Storage methods:

+ Pod storage for at least one month	69%
+ Grain treatments:	
.. Insecticides	28%
.. Ash	24%
.. Local herbs	6%
.. Ash + Local herbs	17%
.. Treatment	13%

. Grain characteristics:

+ Color	
.. White	76%
.. Brown	15%
.. Red	9%
.. Black	5%
.. Speckled	3%
.. No preference	9%
+ Size	
.. Large	71%
.. Small	10%
.. Medium	10%
.. No preference	9%

. Human consumption of cowpea leaves: 81%

. Use of cowpea fodder 91%

. Pod characteristics:

.. Non-dehiscence	47%
.. Long-large	36%
.. White color	26%
.. Small	8%
.. Purple color	2%

- **Preliminary yield evaluation**: Materials from IITA international trials were evaluated at Mouda. Based on station, farmer and research selections, the following cultivars were identified: VYA, IT86D-719 and IT85D-3517-2. Crosses were initiated to improve the resistance of IT86D-719 to bruchids resistance.

- **Regional adaptation trials**: The trial was conducted at 5 locations in northern Cameroon. Three high yielding cultivars with good level of bruchid seed and/or pod resistance (viz. IT86D-364, IT87S-1393 and IT81D-1137) were identified. IT87S-1393, whose pods are easily broken, is being subjected to crossing to improve the hardness of its pods. Other lines being improved include: IT86D-364, IT81D-1137 and IT86D-713.

b) **Storage**

- **Solar heating device for use by low resource farmers in reducing cowpea losses to Callosobruchus maculatus**: Four large solar heaters (3 x 3 m) with the capacity to treat 50 kg of cowpea seeds were tested for their effectiveness:

The experiment was conducted on December 18, 1990. In solar heaters (made of a transparent polyethelene sheet and/or a black polyethelene sheet lying on a cushion 4-5 cm thick, of cowpea dry plant materials), a temperature of at least 57°C was maintained for a minimum period of an hour (between 10.50 and 13.50 h) good enough to kill all stages of *C. maculatus*. No adult bruchids emerged from the solar heater treated grains at 35 days after infestation, whereas 403 adults emerged on the average from the check.

It is advisable to store solar heater treated cowpea grain under air tight conditions. This can be achieved by use of the double or triple plastic bags, sealed tightly. Another choice is to store treated grains in sterilized granaries covered with a 2-3 cm of ash to prevent bruchids reinfestation.

- **Utilization of solar heaters to control Bruchidius atrolineatus infestation**: The design was similar to the one used for suppressing *C. maculatus*, except that the plastic sheets were smaller (1 x 1m) and the experiment was conducted on November 19, 1990. Similar results were obtained as in the *C. maculatus* experiment described above.

- Use of ash in cowpea grain storage: Cowpea grain stored with ash with a minimum of 3 volumes of ash for 4 volumes of cowpea grains destroyed weevil population completely. Also 3-4 cm layers of ash on top of a container of stored cowpea grain, stops reinfestation of adult weevils.

- Pre-harvest evolution of bruchid population in northern Cameroon: The experiment consisted of 3 sampling methods (D-VAC traps, seed trap and a sticky matter trap) in four replications. The field plots were not treated with any insecticide. The sticky matter trap and D-VAC trap were effective methods for sampling bruchids in the field. For the seed traps, number of bruchids that was trapped on the seeds was of no singificant importance, but the eggs which they oviposit was serious.

  With the sticky matter trap, nearly twice as many bruchids (160 vs 80) were caught as compared to the D-VAC trap during the peak period at 99 days after sowing, October 23, 1990. Unfortunately, it was more difficult to differentiate *B. atrolineatus* from *C. maculatus* with sticky matter trap than with D-VAC trap.

GHANA

a) Breeding

- Local germplasm collection: In cooperation with the Germplasm Unit of IITA-Ibadan, 90 landraces and 169 wild cowpea varieties were collected. Studies were initiated in collaboration with an entomologist to screen the germplasm against major insect pests of cowpea.

- Crossing program: (i) Local variety Dagarti has been crossed with IT81D-716 and IT83S-728-13 with the objective of improving its resistance to aphids and bruchids; (ii) A hybridization program to incorporate heat resistance or tolerance for northern Guinea and Sudan savannas using pedigree-backcrossing method was carried out. It involved the following varieties: Vallenga (IT82E-16), Sumbrizie, Sumbrisogla and IT81D-1137; (iii) Line CR-O6-67, a product from cross between Amantin and Asontem (IT82E-32), was the most promising line in multilocation testing in humid and subhumid zones. It was proposed for on-farm testing in Ghana and the RENACO regional testing for the 1991 cropping season.

- Evaluation of exotic germplasm and variety trials: (i) In the humid and subhumid zones, the following were the most promising lines from the regional trial of 1989-9O: Bruchid resistance trial: IT86D-544, IT86D-641 and IT81D-1137; and Aphids resistance trial: IT86D-444, IT85D-3577 and IT86D-888. They shall be subjected to on farm-testing in 1991; (ii) Six promising lines introduced from RENACO-SAFGRAD were subjected to multilocation testing in northern Ghana in 1989 and 199O; line KVx65-114 performed best at most locations during both years.

b) Entomology

- Screening cowpea for field insect resistance: (i) Forty-two local varieties were screened for resistance to field insect pests in humid and subhumid zones. A few varieties have shown promising resistance to aphids, flower thrips and pod borers. They shall be subjected to biological tests in the screenhouse to confirm their resistance; (ii) Thirty-one early maturing lines from IITA were field screened for resistance to flower thrips and *Maruca* pod borers in northern Guinea savanna. To accomplish this, lines were sprayed every two weeks beginning 5O% flowering with

Monocrotophos (250 g. a.i./ha) insecticide to control thrips and pod sucking bugs but not *Maruca*. Lines were scored for resistance to thrips 35-37 days after sowing before insecticide application. About 81% of the lines were ranked to possess some level of resistance to thrips and about 58% to *Maruca* pod borers.

- Minimum insecticide treatments: Two cowpea varieties (improved and a farmer's variety) and three insecticide regimes (O, 2, and 3 sprays) were tested in both humid and subhumid zones and in northern Guinea and Sudan savanna zones. In general, insecticide application reduced insect damage to the crops and increased grain yield. Perhaps, with the exception of Nyankpala station, two insecticide sprays (one at flower bud formation and the other at pod formation) significantly increased cowpea yield of both cultivars. In most cases, the third insecticide spray did not substantially increase cowpea yield.

- Evaluation of plant products in cowpea storage: Eleven plant products were tested along with insecticide (Actellic 2% dust) to control cowpea weevil during storage in humid and subhumid zones. Four products (viz. neem seed oil, jatropha seed oil, groundnut oil and black pepper powder) were as effective as Actellic 2% dust in protecting cowpea grain against weevils for at least six months.

- Insect pest dynamics in cereal-cowpea intercropping: The study was conducted in northern Ghana in farmers' field. It involved cereals (maize or sorghum) and cowpea mixtures. The insect pests studied included aphids, flower thrips and damage caused by *Maruca*. Insect activity on companion cereal crop was limited to a few aphids observed mainly on maize together with small members of pod sucking bugs (*Anoplocnemis curvipes* and *Nezara viridula*) basking and/or roosting on maize. The study will be repeated next year.

c) *Striga* resistance studies:

A *Striga* sick plot was established in the Sudan savanna zone in 1990. Cowpea lines and cultivars from the Ghana germplasm collection were screened for resistance/tolerance to *Striga gesnerioides*. Cultivar SUVITA-2 and a local variety, Sumbrisogla, exhibited a good level of *Striga* resistance. They shall be used as breeding parents for *Striga* resistance.

d) Agronomy

Cereal-legume intercropping systems were studied at three locations (Pokoase, Fumesua and Kpeve) in coastal savanna, forest and transition zones. Two maize cultivars: Dobidi (full season and tall) and Aburotia (medium maturing and short) were used. Cowpea crops were sown at two dates namely, simultaneously with or 5 days after maize. Maize grain yields were not affected by intercropped cowpea at all locations. Yields of cowpea were, however, slightly reduced when sown simultaneously with the maize cultivar Dobidi.

NIGER

a) Breeding

- Preliminary yield trials: Two preliminary yield tests were conducted in 1990, one at Kolo and Tarna and the other at Kolo only. The entries included 30 lines from a cross of KNS x TN88-63 and two checks. For the first trial, the following were the best lines at both locations: KB89-7, KB89-8, KB89-2, KB89-13 and KB89-11; they significantly out-yielded the best check TN88-63. For the second trial, none of the lines significantly out-yielded the best check.

- **Advanced collaborative trial**: Thirty-six entries developed by INRAN and IITA/ICRISAT were tested at several locations in Niger in 1989 and 1990. The best performing lines and cultivars across locations in terms of grain yield were: ITN89E-4, TN5-78, IT85S-265-72, ITN89E-3 and KC85-7 whereas entries KVx100-2, KA85-23, KB85-18 and KB85-14 gave the best fodder yield across locations.

- **RENACO regional adaptation trial for Sudan savanna and the Sahel**: The trial was conducted at Kolo in 1989 and at Kolo, Gabougoura and Ouallam in 1990. At Gabougoura, entries were exposed to high pressure of **Striga** infestation and **Macrophomina** disease; whereas at Ouallam they were exposed to heat and drought stresses. Across years and locations TN5-78, KVx396-4-5 and KVx30-309-6G gave the best performance for both grain and fodder yields. The KVx lines were less attacked by bacterial blight.

- **Adaptation trial for local varieties**: Twenty entries of which 14 local landraces collected in 1987 and 6 commercial cultivars as checks were tested at Ouallam, in the Sahel, and Kolo and Tarna in Sahelian-Sudanian zones in 1990. At each location, some local varieties yielded similarly if not better than the commercial varieties. The best performance across locations was obtained for grain yield with local varieties: TN87-28, TN87-127 and TN87-41B and fodder yield with TN87-256A, TN87- 182, TN87-28 and TN87-127. Thus, TN87- 28 and TN87-127 were found to be good dual purpose varieties.

- **Study of varietal mixture**: Two varietal mixtures (i) KVx100-2 and TN5-78, two cultivars of different growth cycles and fodder yields; (ii) KVx30-309-6G and Gabougoura local, a late maturing landrace were studied. A total of 10 treatments (4 pure-stand, 2 mixtures: 50% + 50%; 2 mixtures: 75% + 25% and 2 mixtures: 25% + 75% treatments) were used. The experiment was established at two locations:

Gabougoura and Ouallam in 1990. The pu pose of the experiment was to study the population buffering effect introduced by varietal mixture against pure varietal effect under high disease pressure or under drought stress. Because of high *Striga* pressure at Gabougoura, no reliable data could be obtained at that location. At Ouallam, 2 mixture treatments KVx100-2 (75%) + TN5-78 (25) and KVx100-2 (25%)+ TN5-78 (75%) yielded equally or higher than the pure-stand treatments.

b) *Striga* resistance studies:

- *Striga* resistance observation nursery: Ten of 70 entries, for which screening for *Striga* resistance was initiated during the 1988 off-season, were observed alongwith one resistant check (B301) and one susceptible check (TN88-63) for *Striga* resistance as well as for yield potential in two separate *Striga* sick plots in 1990. Varieties TC85-252, 100-8, TN49-80 and TN99-80 had the lowest number of *Striga* shoots per plot; they appeared thus to be *Striga* resistant. The resistant check B301 had no *Striga* shoot in its plot. Of the resistant varieties, only TC85-252 and TN49-80 gave the highest yield which was comparable to that of the susceptible check TN88-63 (the latter had the highest number of *Striga* shoots per plot; it is also known to be *Striga* tolerant). The *Striga* resistant check gave the lowest yield.

- Advanced Striga resistance trial: Nine cultivars were tested at four locations: Tarna, Magaria, Koni and Kalapate, in *Striga* sick plots. B301 was infested by *Striga* at Magaria and Koni; and IT82D-849 at Magaria only. The number of *Striga* shoots, if any, on the plots of the afore-mentioned *Striga* resistant varieties, was the lowest. Cultivars which bore the lowest number of *Striga* at the first *Striga* count had also the least number of *Striga* at maturity. To this effect, *Striga* population dynamics

are distinguishable by three curve shapes: S shape: for *Striga* susceptible cultivars (TN88-63, Mougne, TN8O-8O); linear or quadratic shapes: for *Striga* resistant (B3O1, IT82D-849, SUVITA-2, TN5-78, TN121-8O). However at Koni, TN121-8O, TN5-78 and SUVITA-2 produced more *Striga* shoots than the susceptible checks TN88-63 and Mougne.

- RENACO regional *Striga* resistant trial: Twelve entries from RENACO were tested at Tarna in a *Striga* sick plot. Cultivars which were infested with the least number of *Striga* shoots were: KVx396-4-4-4, IT82E-32 (the susceptible check), TN121-8O, KVx396-4-4-2, B3O1, SUVITA-2, and IT82D-849. The highest yield was obtained from TN121-80, TN93-80 and KVx396-4-4-4; and the lowest yield, by KVx396-11-6, B3O1, IT82E-32, IT82D-849.
- Effect of cowpea plant population on *Striga* infestation: The *Striga* tolerant cultivar TN88-63 was sown in a *Striga* sick plot at six plant populations varying from 6,944 to 111,111 plants/ha. *Striga* density measured at cowpea maturity increased with decreasing cowpea plant population whereas cowpea grain yield increased with cowpea plant population.

c) Agronomy

- Effect of continuous cultivation of millet and cowpea on soil fertility in the Sahel: Continuous cultivation of millet and cowpea pure-stand croppings and millet-cowpea intercroppings with cowpea sown 2 and 8 weeks after millet were studied. The afore-mentioned treatments were used for three years before the actual experiment was started in 1989; and for each year, crop residues were removed. Soil analysis carried at the beginning of the 1989 cropping season showed soil organic matter and exchangeable Mg to be higher in plots that received continuous pure-stand cowpea than other treatments. Millet, as the test crop, absorbed

more N on plots that received high levels of N fertilization in 1989, pure stand cowpea and millet-cowpea intercropping with cowpea sown 2 weeks after millet than other treatments. Therefore, cowpea, pure-stand crop especially, appears to be a good preceding crop to millet.

NIGERIA

a) Breeding

- Cowpea Preliminary Yield Trial: Sixty entries of which Sampea-7, used as check, at Samaru in the northern Guinea savanna and Minjibir in the Sudan savanna were yield-tested. Five lines at Samaru and 13 at Minjibir, gave a cowpea yield of more than 1 t/ha. The check Sampea-7 was out-yielded by 31 lines at Samaru and by 14 lines at Minjibir.

- Advanced Yield Trial: Thirty entries with Sampea-7 used as a check were evaluated at Samaru and Minjibir. The best among the 10 top lines at both locations were 1696/K59-39, 1696/TVx3000-25, 1696/TVx3000-1, 48W and Dan-Sokoto. The check Sampea-7 was not among the best 15 lines at each of the two locations.

- Dual Purpose Trial: Ten lines were tested at Samaru, Minjibir and Gusau (Sudan savanna zone) for grain and fodder yields. Line 7/18O-5-1 was the best performing for both traits at all the tested sites. Other lines of interest included 7/18O-4-5B and 4/48-15-1.

- Cowpea Adaptation Trial: Nine promising lines including Sampea-7 were subjected to multilocation tests at 14 locations in State farms in northern Nigeria. Feedback received from 12 locations showed the following lines and cultivars to be among the 3 top promising lines: IT82D-699 (5O%), 11/48-2 (5O%) and the check Sampea-7 (42%).

- Elite Variety Test: Seven elite varieties from IAR and IITA and a check (farmers'variety) were tested at four locations by agricultural development projects for adoption by farmers. The following cultivars were among the 3 top performing lines: IT82D-699 (75%), IT84S-2246 (5O%) á, IT86D-715 (5O%) and IAR-11/48-2 (5O%).

- RENACO Regional Adaptation Trial for Northern Guinea Savanna: Nine cultivars introduced from RENACO and a local check, Sampea-3, were tested for the second time at Samaru in 199O. The best performing cultivars included KVx396-4-2, KVx396-4-4, KVx396-4-5, KVx396-18 and KN-1 (Vita-7). Their yields were similar but significantly greater than the local check, Sampea-3.

- RENACO Regional Trial for Adaptation to Sudan Savanna Zone: Eleven cultivars and a local check (Sampea-3) were tested at Minjibir using two sowing dates in 199O. The field plot was heavily infested with Striga. The best performing cultivars at both sowing dates were: KVx396-4-5, IT85D-3516-2, KVx396-11-6, KVx396-4-4 and KVx396-18-1O. They yielded similarly to one another at both sowing dates but significantly out-yielded the local check Sampea-3, only at the first sowing date.

- National Cowpea Variety Trials:

  Early maturity trial: The trial was conducted at Samaru. It consisted of eight entries. None of the entries produced a yield up to 2.O t/ha: IT82D-719 was the highest yielder (1.6 t/ha) and IT86D-88O the lowest (O.9 t/ha).

. Medium maturity variety trial: The trial of 16 entries was conducted at Samaru. Only two entries IT86D-957 and IAR-11/48-2 out-yielded the check Sampea-7, but the difference was not statistically significant.

b) Entomology

- Biology and Bionomics of Clavigralla spp: Pod sucking bugs infestation was less severe and even occured much later in 1990 than in 1989. It was noticed that the insects preferred a heavy and thick than light and scattered canopies for laying their eggs. It was therefore very easy to control the multiplication of insects by simply pulling off the leaves containing the eggs.

- Screening Cowpea Lines for Resistance to Insect Pests:

. Eight lines from IITA (IT87S-1394, IT85D-3577, IT86D-444, IT87S-1390, IT84S-2246, IT82E-25, IT87S-1459 and IT87S-1393) and a check Sampea-7, were screened for aphids resistance at Kano (RENACO regional trial). Only Sampea-7 showed aphids infestation.

Thirteen landrace varieties were screened for resistance to flower thrips and *Maruca* pod borers in the Sudan savanna zone. The following varieties exhibited good level of resistance or tolerance to both insects: Achishuru (red), Dan-Alokowa, Achishuru (purple) and Dan-Karaduwa.

. Three cowpea varieties IT84S-2246, Sampea-7 and Dan-Illa with erect, semi-erect and creeping growth habits respectively, were evaluated for pod damage caused by bugs in the Sudan savanna zone. Dan-Illa with creeping growth habit had the least pod damage.

- **Chemical Control of Insect pests:**

  Screening of insecticides: Five insecticides (viz. Cymbush super ED, Sherpa plus, Fastac, Polythrin EC and ULV) were compared with an insect growth inhibitor, CGA184699, at Minjibir. CGA184699 is specific on lepidopterous larvae. Insecticides Cymbush super ED, Sherpa plus, Fastac and Polythin controlled flower thrips better than CGA184699 and the check, unsprayed treatment. CGA184699 appeared, however, to control *Maruca* pod borers as effectively as the insecticides.

  Minimum insecticide trial: This is a component of RENACO regional trial. Three varieties: IT84S-2246, Dan-Illa and Konanado were subjected to three insecticide spray regimes (O, 2 and 3 sprays) using the insecticide Sherpa plus. Insect pests were progressively controlled with increased number of sprays. Yields also increased significantly with increased number of sprays but yield difference between 2 sprays and 3 sprays was not great (O.96 vs 1.13 t/ha). With the daylength sensitive variety, Kananado, one or two sprays at flower bud formation were sufficient to protect against insect pests. The results confirm similar results observed in 1989.

- **Intercropping cowpea with pepper as cultural control against cowpea insect pests:** Cowpea was intercropped with Chilli pepper at Minjibir. The objective of the trial was to study the effect of Chilli pepper on cowpea insect pests. As observed in 1989, Chilli pepper had no effect on cowpea flower thrips and *Maruca* pod borers. Pod sucking bugs were not counted because of the low number of pods.

(c) **Pathology**

- Preliminary Evaluation of Advanced Lines for Disease Resistance: Twenty three lines from IAR were screened in the field at Samaru in northern Guinea savanna for disease resistance. Five lines (1696/K59-1, 11/48-2, TVx3OOO/K59-22, 11/48-3-1 and 1696/K59-9) appeared to be resistant to both scab (*Elsinoe phaseoli*) and Septoria (*Septoria vignae*). But, with perhaps the exception of 11/48-3-1, none of them was resistant to bacterial blight (*Xanthomonas vignicola*).

- Screening of Cowpea Lines and Cultivars for Multiple Disease Resistance: Lines and cultivars used in IITA international trials and all Nigeria coordinated trials were subjected to screening for multiple disease resistance at Samaru in 199O. To ensure good level of bacterial blight infection in the field, seeds of plants which were severely attacked by the disease in 1989 were sown as spreader plants at both ends of each test row.

The results were as follows:

CIT1 (IITA extra-early lines): None of the 9 lines tested combined resistance to scab, Septoria leaf spot and bacterial blight disease.

.. IT86D-1O56 had good level of resistance to scab and *Septoria* leaf spot.

.. IT86D-792 was resistant to *Septoria* leaf spot and had a moderate level of resistance to bacterial blight.

.. IT86D-782 had a moderate level of resistance to *Septoria* leaf spot and bacterial blight.

CIT2 (IITA medium maturing lines): None of the 9 lines evaluated had combined resistance to scab, *Septoria* leaf and bacterial blight disease.

.. IT85D-385O-1 had high level of resistance to *Septoria* leaf spot and moderate resistance to bacterial blight.

.. IT85D-385O-2 was resistant to *Septoria* and had a moderate level of resistance to bacterial blight.

.. IT84S-2244 had high level of resistance to scab and bacterial blight.

. CIT3 (IITA Bruchid resistance trial): None of the 9 tested was resistant to scab, *Septoria* leaf spot and bacterial blight.

. CIT4 (IITA Aphid resistance trial): Only IT85D-3577 exhibited a reasonable level of resistance to *Septoria* leaf spot.

. CIT5 (IITA vegetable cowpea trial): None of the 9 lines tested was resistant to scab, *Septoria* leaf spot and bacterial blight.

. CIT6 (IITA virus resistance trial): Of the 13 lines tested, only IT81D-1137 had moderate level of resistance to scab, *Septoria* leaf spot and bacterial blight.

.. IT82E-16 was resistant to bacterial blight and was highly resistant to *Septoria* leaf spot.

.. IT83S-872 had high level of resistance to *Septoria* leaf spot and bacterial blight.

. CIT7 (IITA cowpea international trial): Only IT85D-3517-2 exhibited moderate level of resistance to scab.

.. IT82D-849 and IT86D-371 had a good level of resistance to scab.

. CIT9 (IITA Cowpea interntional trial): Nine lines were screened for scab and *Septoria* leaf spot.

.. IT86D-4OO and IT86D-422 had high levels of resistance to *Septoria* leaf spot and scab.

. Nigeria national coordinated trials: Out of the 3O lines and cultivars screened for scab and *Septoria* leaf spot, only the following three were resistant to both diseases: FARV-13 (vegetable cowpea), K-59 and H-113-4.

- Chemical disease control

. Effect of seed treatments on cowpea seed-borne scab disease: The objective of the trial was to study the effect of seed treatments on control of scab disease on cowpea seedlings four weeks after sowing. Seven fungicides (Delsene M (Carbendazim + maneb), Rovral TS (carbendazim + maneb), Benlate (benomyl), Benlate + Dithane M-45 (benomyl + mancozeb), Fernasan D (thiram), Dithane M-45 (mancozeb) and Apron plus (metalaxyl + Caboxin)) were compared to a check (unsprayed treatment) at Samaru in 199O. Benomyl and Carbendazim were more effective than any of the other tested fungicides (including the popularly used Fernasan D) in controlling the seed-borne scab disease. Apron Plus was found to be the least effective fungicide.

Effect of fungicidal spray regimes on the control of scab and Septoria leaf spot diseases: The effect of date of commencement of fungicidal sprays (5, 6 or 7 weeks after sowing) and the frequency of sprayings (at 7 or 14 days intervals) were studied at Samaru, with a fungicidal mixture of Benomyl and Mancozeb. The best scab control and high cowpea grain yield were obtained with the treatment: "spraying 5 weeks after sowing (WAS) at 7 days interval". Other treatments of interest included:spraying 5 WAS at 14-days interval, spraying 6 WAS at 7-days interval, and spraying 7 WAS at 7-days interval.

d) **Striga control studies**

Evaluation of cowpea lines and cultivars under natural Striga infestation: Two trials were conducted in a **Striga** sick plot at Bakura (in the Sahel) in 199O.

Reaction of IITA lines to Striga infestation: Seven IITA lines were compared to three resistant cultivars (B3O1, IT82D-849 and Suvita-2), and one susceptible cultivar (TVx3236) as a check. All the lines except IT81D-994 and IT81D-985 had less than one **Striga** shoot per m^2; the susceptible check, TVx3236, had five **Striga** shoots per m^2. In spite of **Striga** infestation, cultivars IT81D-994 and IT81D-985 together with **Striga** resistant cultivars Suvita-2 and IT82D-849 had the highest crop vigour and produced acceptable yields.

Reaction of Promising Introduced Lines to Striga Infestation: Thirteen promising lines introduced from IITA-Ibadan and RENACO, three known susceptible cultivars (TVx3236, Ife brown and Sampea-7 (IAR-48)) as checks and three resistant cultivars (B3O1, IT82D-849 and Suvita-2) were tested in a *Striga* sick plot at Bakura in 199O. TN93-8O from RENACO, had only one *Striga* shoot in one replication; it had the highest yield, and was thus, the most

Striga resistant cultivar. IT82D-849, IT84D-666,B301, Suvita-2 and IAR 48 had the lowest number of *Striga* shoots but yet yielded the least; KVx3O-322 (SR322), TN121-8O, Vita-3 and IT86D-843 had a moderate *Striga* attack, but with good vigour and produced acceptable yields. KVx396-8- 5G, had the highest level of *Striga* infestation, yet gavean acceptable yield, it appears, thus, to be *Striga* tolerant. The other lines or cultivars were not of any particular interest.

- RENACO Regional Cowpea Striga Resistance Trial: Twelve lines and cultivars of known *Striga* resistance characteristics at places of origin were screened for resistance in a *Striga* sick plot at Minjibir, Sudan savanna, in 199O. B3O1 was free from *Striga* attack and produced an acceptable yield. Suvita-2 and IT82D-849 had high level of resistance to *Striga* but produced a very low yield. TN121-8O and TN93-8O combined very low *Striga* counts with acceptable grain yields; they were, thus, moderately resistant to *Striga*. KVx396-4-4-4 and KVx396-4-4-2, in spite of high level of *Striga* attack, gave the highest yield; they were, thus, *Striga* tolerant. The others lines and cultivars were not of particular interest.

- Striga Control Through Crop Management:

  Effect of nitrogen source on Striga infestation: Two N sources (urea and calcium ammonium nitrate (CAN)) at three levels each (O, 3O, 6O kg N/ha) were tested at Darazo, Bauchi state, northern Nigeria, using three cultivars (Sampea-7, Striga susceptible, and Suvita-2, *Striga* resistant and a farmer's variety). N sources and N levels had no statistically different effect on *Striga* attack, though 6O kg of N/ha tended to reduce

number of *Striga* shoots per plot as compared to the unfertilized check. It should be pointed out also that CAN fertilized plants tended to withstand *Striga* shoots more than the urea fertilized ones. Cultivar Sampea-7 had significantly higher number of *Striga* shoots than the other two tested entries. It was, thus, the most *Striga* susceptible cultivar. Cowpea vigour and yield increased with increasing levels of applied N. Suvita-2 significantly out-yielded the two other cultivars. As observed in 1989, it appeared, thus, that N application improved cowpea nutrition and enabled it to tolerate or better resist *Striga* attacks.

e) **Agronomy**

- **Effect of seed-size and phosphorus rates on growth and yields of cowpea**: Three seed sizes (small, medium and large); three phosphorus levels (O, 37.5 and 75 kg P_2O_5/ha) were studied at Samaru using two cultivars (Kano 1696 and Sampea-7). Seed sizes, irrespective of cultivars sown, had no significant effect on cowpea yield and all yield components other than number of seeds per pod and threshing percentage. Increasing levels of phosphorus positively and significantly affected all the studied yield components except for 100-seed weight, and grain yield. Sampea-7 significantly out-yielded Kano 1696.

- **Effect of rate and time of nitrogen application on cowpea yield**: Four rates of N (O, 20, 40, 60 kg N/ha) and three times of application (full dose at sowing, full dose at flowering, and half dose at sowing and half at flowering) were studied for their effect on cowpea productivity, using cultivar Sampea-7. Both rates and time of N application had no significant effect on cowpea grain yield. Similar results were obtained in 1989.

- Effects of rate of nitrogen and phosphorus on cowpea yield: Three levels of N (O, 3O and 6O kg N/ha) and three levels of P (O, 3O and 6O kg of P_2O_5/ha) were studied for their effects on cowpea productivity at Samaru, using a farmer's variety, Achishuru, and an improved cultivar, Sampea-7. Cowpea yield exhibited a quadratic response to N, reaching an optimum of 3O kg N/ha and an "S" shape response to P, reaching a plateau after 3O kg P_2O_5/ha. Sampea-7 significantly out-yielded Achishuru.

- Evaluation of herbicides on weed control on cowpea: The experiment was conducted at two locations, Kadawa and Samaru, in 199O. The field plots were ploughed, fertilized and ridged. Cowpea plants were fully protected against insect pests and diseases by spraying insecticides and fungicides, respectively. Pre-emergence herbicides were applied one day after sowing while post-emergence herbicides were applied 3 weeks after sowing (WAS).

At Kadawa, a tank-mixture of Metolachlor + Imazethapyr (at a rate of 1.25 + O.O5 kg a.i./ha) applied at pre-emergence effectively controlled weeds up to 9 WAS; it resulted in good crop vigour and high yield than hand-hoe control and the recommended herbicide, Metolachlor + Metobromuron (Galex) followed by supplementary hand-hoeing. Other treatments of interest included the formulated mixtures : (i) Pendimethalin + Imazaquin (squadron) applied at pre-emergence (at the rates of O.12 + O.7O and O.15 + O.87 kg a.i./ha), (ii) Pendimethalin + Imazethapyr (Pursuit plus) applied at pre-emergence and early post-emergence (3 WAS) (at rates of O.O72 + O.95 and O.O96 + 1.27 kg a.i./ha), and (iii) Imazethapyr + Fluazivop butyl applied early post emergence (at the rate of O.O75 + O.5 kg a.i./ha). These treatments did not require any supplementary weed control.

At Samaru, pre-emergence application of Squadron (at O.82 and 1.O2 kg a.i./ha), Pursuit plus (at 1.O2 kg a.i./ha) and Metolachlor + Imazethapyr (at 1.25 + O.O25 kg a.i./ha) without supplementary hoe-weeding, combined effective weed control with cowpea grain yield similar to that of hoe-weeding control.

Despite good control throughout the crop season obtained with early post-emergence application of mixtures of Fluazivop butyl + Imazethapyr, low grain yields were produced. The control treatment, experienced 42.7 and 62.7% yield losses at Samaru and Kadawa, respectively since weeds were not suppressed throughout the crop season.

SENEGAL

a) Breeding

- **Advanced yield trial**: Fourty four advanced lines were tested along with a common check 58-57 at 3 locations (Bambey, Thilmakha and Louga) in 199O. Results from Bambey and Thilmakha showed lines B89-5O4 and IS86-275 to be free from viral and bacterial disease infections; they were not attacked by aphids and significantly out-yielded 58-57 at both locations. The trial at Louga was damaged by the insect, *Amsacta moloneyi*.

- **Multilocation trials**: New improved cultivars (IS86-275 and B89-5O4) and two commercial cultivars (58-57 and Bambey-21) were subjected to multilocation testings including on-station and on-farm in central and northern regions of Senegal in 199O. Results from Bambey, Thilmakha and Ndiol showed the new varieties to perform either equally or better than the best commercial cultivar.

b) Pathology

- Effect of seed treatments with fungicides on cowpea germination: A new fungicide, Sumi 8 (Diniconazole), was tested at 4 rates (O.5, 1.O, 2.O and 4.O g/ha of seeds) against Granox (mixtures of Copper oxyquinoleate (15%) + Lindane (2O%)) and a check (no seed treatment). (Granox is a currently used commercial product; it was used at the recommended rate: 2 g/kg of seeds). Granox was more effective than Sumi 8 at all rates in improving cowpea seed germination.

c) Striga resistance study

- Screening cultivars for Striga resistance: Seven Senegalese cultivars were subjected to screening for *Striga* resistance in a *Striga* sick plot at Ndat Fall in 199O. Three *Striga* resistant cultivars IT82D-849, B3O1 and Suvita-2 were used as checks. The results were as follows:

  . *Striga* resistant: IT82D-849 and B3O1 with O.O - O.3 *Striga* shoot per plot;
  . High to moderate level of *Striga* resistance: IS86-275, IT81D-1137, IS86-283N and Suvita-2 with 2.7 -1O *Striga* shoots per plot;
  . *Striga* susceptible: 58-57, B89-5O4N, CB5 and Mougne with 51.3 - 1O9 *Striga* shoots per plot.

d) Microbiology

- Effect of a new strain of Rhizobium on cowpea performance: A new strain of Rhizobium MAO286, isolated from line IS86-279 and selected for its efficacy in the laboratory, was field tested against native *Rhizobium* strains at Thilmakha in 199O. The trial consisted of four soil treatments (inoculation with *Rhizobium* MAO286, inoculation with

Rhizobium MAO286 + 1O% of arabic gum water solution, 2O kg of urea/ha, and control: no treatment at all) and three cowpea entries (IS86-283, 58-57 and Ndiambour). Only inoculation of *Rhizobium* MAO286, particularly when a 1O% arabic gum water solution was added, significantly increased nodule dry weight of all entries and grain yields of IS86-283 and Ndiambour. Yield data of 58-57 was not obtained.

e) Agronomy

- On-farm testing: A new promising line, IS86-275N was tested on-farm against commercial cultivars: 58-57, Ndiambour and Bambey-21; cultivar Mougne replaced Bambey-21 at some locations. Results averaged over six locations showed the best performing entries to be as follows in decreasing order: IS86-275, 58-57, Ndiambour and Bambey-21.

f) Socio-economic studies:

Surveys conducted in 199O revealed farmers' reactions as follows:

. 7O% of male farmers consider insect pests: *Amsacta moloneyi, Aphis craccivora, Megalurothrips sjostedti* and *Callosobruchus maculatus* to be the major cowpea production constraints.

. The majority of female farmers consider, in contrast, cowpea pod harvesting, drying, threshing and storage to be the major cowpea production constraints.

. The second major cowpea production constraint acknowledged by both gender groups was cowpea marketing due to poor revenue as well as to uncertainity of market.

. 75% of cowpea produced is auto-consumed and only 25% is marketed.

B E N I N (Associate Center)

a) Breeding

- Germplasm conservation: The entire germplasm collection of Benin was planted in 199O for regeneration as well as for field observation purposes.

- Breeding nurseries: Crosses were made with the objectives of improving cowpea for bruchid resistance, grain quality (white and large seeds) and plant type. Lines from F2 to F8 were evaluated during the season.

- Cowpea variety trials: Several cowpea variety trials were conducted in 199O throughout the country as follows:

  . Early maturing cultivars: The trial was established at two locations, Niaouli and Adjohoun, in Southern Benin. Only cultivar IT86D-1O1O from IITA performed either equally or better than the local variety, Kpodjiguegue, at both locations.

  . Medium maturing cultivars: The trial consisted of 1O cultivars from IITA and was established only at Niaouli. Only IT86D-535 gave a yield greater than 1.O t/ha.

  . Variety trial for adaptation to savanna zones: The trial consisted of 9 cultivars from IITA; they were compared to a local check at Savé and Iboulofin in the south of Benin and at INA, Ndali, in northern Benin. Only cultivar IT85D-3517-2 performed well across locations.

Nationally coordinated variety trial: The trial consisted of 12 best lines identified from previous research work in the south as well as the north. In the south, the trial was established at six locations. Only cultivars IT84S-2246-4 gave the best performance (92 to 141% of the check) across locations. Other cultivars of interests were: IT84D-513 and TVx185O-O1F. In the north, the trial was established at four locations. Only TVx1999-O1F gave the best performance across locations; it was consistently among the six top yielders. Other cultivars of interest were TVx185O-O1F and IT81D-1137.

Yield trial for bruchids resistant cultivars: It consisted of 9 bruchid resistant lines from IITA and a local check: Kpodjiguegue. The trial was established at Niaouli. Cultivars IT86D-364, IT84S-2246-4 and Kpodjiguegue gave yields greater than 1.0 t/ha.

Yield trial for aphid resistant cultivars: The trial consisted of 9 aphid resistant cultivars from IITA and a local check: Kpodjiguegue. It was established at Niaouli. None of the introduced cultivars out-yielded Kpodjiguegue.

b) Striga Resistance Studies

RENACO regional Striga resistance trial: The trial consisted of 12 cultivars from RENACO; it was established at two locations: Tindji and Bohicon, in farmers fields in southern Benin. At both locations, no *Striga* shoot emerged in plots of cultivars KVx396-6-1, B3O1, IT82D-849, TN93-8O, TN121-8O and Suvita-2. Yield-wise, *Striga* susceptible cultivars, IT82E-32 and IT82E-16, out-yielded or yielded equally as the best *Striga* resistant cultivars IT82D-849 and B3O1 at both locations. All the other above-cited *Striga* resistant cultivars gave low yields because of their susceptibility to viral and fungal diseases.

- **IITA international Striga resistance trial**: The trial consisted of 10 entries from IITA/Ibadan; it was established at two locations; Agbangnizoun and Zakpota, in farmers' fields in southern Benin. At Agbangnizoun, no *Striga* shoot emerged from plots of IT82D-849, IT81D-994, B301 and Suvita-2. At Zakpota, *Striga* shoots emerged in plots of all tested cultivars. It should be noted that:

(i) Cultivars IT81D-994, IT82D-849 and Suvita-2 had the least *Striga* shoots per plot (0.0, 0.5 and 0.75 *Striga* shoot per plot, respectively). *Striga* emerged from their plots 55, 43 and 50 days after sowing; they appeared, thus, to be *Striga* resistant.

(ii) B301 had 2.75 *Striga* shoots per plot; the *Striga* emerged 43 days after sowing; it had, thus, high level of resistance to the Zakpota *Striga* Strain.

(iii) For all the remaining cultivars *Striga* shoots per plot ranged from 7.75 to 32.5 and *Striga* emerged 36-43 days after sowing; they were susceptible to the Zakpota *Striga* strain.

The Zakpota *Striga* strain appeared thus, to be the most virulent in the RENACO member countries. Yield-wise, B301, IT81D-994 and IT82D-849 gave the highest yield at both locations.

M A L I (Associate Center)

a) Breeding

- **Breeding nurseries**: Several crosses were made from 1985 up to date. The objectives are as follows:

  - Disease resistance: (IAR 1696 x Niban) and (Bambey 21 x 15-316).
  - Bruchid resistance: (TVu2027 x TVu123)
  - Grain quality: (IPAO-201 x TVu79).

. *Striga* and drought resistance: (Suvita-2 x TVu 123), (Suvita-2 x TVu79), (B3O1 x IAR-1696), (B3O1 x Niban), (B3O1 x TVu76O7), (B3O1 x Amary shô), (B3O1 x TVu2O27), (IAR-1696 x IT82D-849), (Niban x IT82D-849), (TVu76O7 x IT82D-849), (Amary shô x IT82D-849) and (TVu2O27 x IT82D-849).

The crosses have been advanced to different stages of generation.

- Advanced yield test: Only advanced lines from the cross Niban x IAR-1696 were subjected to yield test in 199O. The best disease resistant lines were as follows:

.. Seed yield (1.5 - 1.7 t/ha) for 6OO-9OO mm rainfall zone: lines: 1O6, 149 and 112.

.. Fodder yield (3.O - 4.5 t/ha) for 6OO-9OO mm rainfall zone: lines: 1OO and 343

- Evaluation of local germplasm: Local cultivars were evaluated throughout the country in 199O. The results were as follows :

.. Early maturing varieties, 55-65 days to maturity for the 4OO-6OO mm rainfall zone: TVx9352, TVu77O7, CIPEA-82673; yields ranged from 7OO to 9OO kg/ha.

.. Intermediate maturing varieties: 75-9O days to maturity, for the 6OO-9OO mm rainfall zone: TVu76O7, TVu7682 and Amary shô yields ranged from 1.O to 1.5 t/ha.

.. Dual purpose cowpea varieties: TVu7968, TVu1O879, TVu7651; seed yields ranged from O.6 - O.9 t/ha and fodder yields from 2.O - 2.5 t/ha.

.. Cowpea varieties for forage or silage for the 6OO-9OO mm rainfall zone: TVu7645, TVu77O2, TVu7632 with fodder yield of about 3.O t/ha.

- RENACO regional observation nurseries: Two observation nurseries were received from RENACO and were established at Cinzana in 199O. The results are as follows:

.. F9 lines combining Striga, Aphids and Bruchids resistance: With respect to seed yield and field disease and insect pests resistance, lines KVx291-47-224, KVx3O5-118-31, KVx3O5-118-32 were the best; their yields ranged from 1.4 to 1.8 t/ha. Other lines of interest included: KVx295-2-124-51, KVx295-2-124-52 and KVx295-2-124-99. The lines were not screened for either *Striga* or insect pest resistance.

.. F8 lines combining good adaptation and Striga resistance: With respect to yield and field disease and insect pests resistance, lines KVx397-9-11, KVx399-29-2 and KVx401- 3-2 were the best; their yield ranged from 1.3 to 1.9 t/ha. Other lines of interest included KVx397-6-6, KVx397-41-1, KVx4O2-5-2, KVx4O2-5-3, KVx4O2-19-5 and KVx4O2-24-6. The lines were not screened for *Striga* resistance.

b) Entomology

- Field evaluation of 9 lines introduced from RENACO for their reaction to insect pests: The trial was established at Cinzana in Sudan savanna zone. Lines IT86D-56O and IT87D-1827 were not infested by aphids; they also had the least number of *Maruca* pod borers. IT86D-56O, IT86D-713 and KN-1 (aphids susceptible check) were among the highest yielding entries. Bruchid resistance biological test conducted in the laboratory revealed IT86D-713 to be resistant; IT84S-2246 and IT87S-1393 to be tolerant; KN-1 was the most bruchid susceptible entry.

c) *Striga* control studies

Studies conducted to date have revealed the following:

- B3O1 and Suvita-2 to be free from *Striga* infestation, though occasionally at some locations few *Striga* shoots have emerged from their plots. This has been attributed either to the presence of out-cross among varieties or new and more virulent strains of *Striga*.

- KVx61-1, KVx65-114, IT82D-849 and KVx61-74 have some level of resistance to *Striga*; they exhibited resistance to *Striga* in some locations and low level of susceptibility in other locations.

- TN88-63 is very tolerant to *Striga*; and

- Bambey-21 is very susceptible to *Striga*.

- RENACO regional *Striga* resistance trial: The trial consisted of 12 cultivars from RENACO. It was conducted at Koporo (in the Sahel) in 1989 and Koporo and Cinzana (in the Sudan savanna) in 199O. The results were as follows: (i) Suvita-2 and TN121-8O were free from *Striga* across years and locations, (ii) TN93-8O, IT82D-849 and B3O1 had few *Striga* infestation, (iii) The best cultivars with respect of yield and *Striga* resistance were Suvita-2, TN121-8O and TN93-8O, and (iv) Other cultivars of interest and having good yields under *Striga* infestation were: KVx396-8-5 and KVx396-6-1.

- *Striga* control measures:

  - Zero-tillage reduced *Striga* infestation by 6O% as compared to ploughing the field plot, but its yield was the lowest.

- In cereal/cowpea intercropping, cowpea was effective in reducing *Striga hermonthica* infestation by 70% (the *S. hermonthica* attacks cereals only). But in case of a mixed infestation of the same field plot by *S. hermonthica* and *S. gesnerioides*, it was better to use cowpea *Striga* resistant cultivar than the susceptible one.
- Soil fertilization improved cowpea vigour, grain and fodder yields as well as *S. gesnerioides* vigour; it, thus, had no effect on *Striga* control.

3.2. REGIONAL TRIALS

The concept of regional trials was discussed at the second meeting of the RENACO Steering Committee in November, 1987 at Ouagadougou, Burkina Faso. Accordingly, regional trials are proposed to national programs after promising technologies have been identified at the biennial workshop. National programs can then receive trials of their choice on request. However, during a non-workshop year, national programs can request from RENACO any trial which for one reason or the other, they were not able to conduct or was judged to have been poorly conducted.

- RENACO Regional *Striga* Resistant Trial:

The 1989 RENACO Regional *Striga* resistant trial which was sent to Benin, Mali, Niger, Nigeria, Senegal and Togo, was repeated in 1990 to ensure uniformity of the seeds. Except Senegal, the other countries reported the results of the trial in their annual country reports and were presented and discussed at the Niamey workshop in March 1991.

From the results obtained, the following varieties were found to be *Striga* resistant: B301, IT82D-849, Suvita-2, TN93-80 and TN121-80. However, Suvita-2 exhibits resistance to *Striga* better in Burkina Faso, Mali, Senegal and Benin. With regards to yield, TN93-80, TN121-80 and Suvita-2 were found to be high yielding in Sudan savanna and Sahel; whereas B301 and IT82D-849 are good for the coastal savanna zones and in *Striga* infested areas of northern Guinea savanna.

3.3. VISITS TO NATIONAL PROGRAMS

Visits were made to national programs either by some members of the Steering Committee or the Network Coordinator.

- **Central African Republic and Tchad:**

Mr. G. Ntoukam, a member of the Steering Committee, visited both countries from 22 September to 4 October, 1990. The impact of RENACO activities is more conspicuous in Tchad than in Central African Republic. A Tchadian scientist took part in one of the in-service training course organised by RENACO in 1989. The following cowpea varieties obtained through RENACO were being grown in Tchad: TVx3236, KN-1, TN88-63, IT81D-985, and IT81D-994; while TVx1948-01F and KN-1 are popular in Central African Republic.

- **The Gambia and Cape Verde**

Dr. O.O. Olufajo, a member of the Steering Committee, visited both countries from 20-29 September 1990. Although, cowpea is important in the diet of The Gambian people, cowpea research is not considered a priority and only a small fraction of the country's requirement is produced. The impact of RENACO activities in the Gambia is witnessed by the two varieties released, namely TVx3236 and TN88-63, while others are in the pipeline for release namely, IT83D-728-13, IT84S-2049 and IT81D-994. A Gambian cowpea scientist took part in the 1990 RENACO cowpea monitoring tour.

- **Cape Verde**

Cowpea is an important component of the cropping system of Cape Verde because of its drought resistance and short growth cycle. Two improved cowpea cultivars introduced through RENACO activities, namely KN-1 and IT83D-442 are in the pre-release stage. With the exception of in-service training, Cape Verde had participated in all RENACO planned activities.

- Niger, Mali and Senegal

Niger was visited by the Chairman of the RENACO Steering Committee, Dr. J. Detongnon, and Dr. N. Muleba, Network Coordinator, from 6-10 June, 1990. The objective of the visit was to help improve the participation of Niger, as RENACO Lead Center, in the network activities. After a meeting held and discussions with the Director General of INRAN and his Staff, justification of funds allocated to Niger in 1988 was received from INRAN. Niger also informed the network about the appointment of a national coordinator for the cowpea research activities in Niger.

Mali and Senegal were visited by the Network Coordinator from September 26 to October 6, 1990. The objective of the visit was to get acquainted with research activities of both countries. In Mali, Mr. O. Kodio, cowpea breeder, was on a study leave for his M.Sc degree in the U.S.A. He was replaced by Mr. A. Traore. Research activities were carried out at Sotuba, Cinzana and Koporo in breeding, agronomy and cowpea *Striga* control. *Striga* resistance work in Mali deserves a special mention for the efforts made in collecting different *Striga* strains in Mali, including one that attacks wild weeds Legumes and Ipomea spp. in order to study their interaction with cowpea Striga resistant varieties. Some promising dual purpose lines are being developed.

In Senegal, cowpea research activities were mainly concentrated in breeding for adaptation to Sudan savanna and Sahel zones with emphasis on disease and *Striga* resistance. Senegal has recognized the importance of *Striga* problem and had initiated breeding work for *Striga* resistance since 1989. Suvita-2, B3O1, IT82D-849, IT81D-1137, IS86-275N and IS86-283 were either found to be *Striga* resistant or had good level of resistance.

In general, Senegal is doing good breeding work and some promising lines have been obtained. However, it should be pointed out that Senegal seems not to be interested in benefiting from the progress made by neighbouring countries to upgrade its breeding work by at least using some of the best introduced materials as checks against its variety trials. Senegal has never requested for the RENACO regional adaptation trial. Even for the only *Striga* resistant trial conducted in 1989, feedback was received for data on *Striga* emergence and *Striga* count but no data on yield.

Senegal had a qualified entomologist, Dr. A.B. Bal, on its research program but has since been working for AGRIMET in Niger. Senegal will therefore, not be able to carry out its RENACO assigned responsibilities as a Lead Center in entomology for Sudanian and Sahelian zones.

3.4. COWPEA MONITORING TOUR

The 199O cowpea monitoring tour started on 27 August and ended on 14 September. Countries visited included Burkina Faso, Niger, Nigeria (northern Nigeria and IITA-Ibadan). A total of 1O scientists from 7 countries (viz. Benin, Burkina Faso, Cameroon, The Gambia, Ghana, Niger and Nigeria) participated. The overall impression of the participants was very satisfactory. They expressed conviction over the need of working together in order to strengthen the research capability of West and Central Africa.

3.5. TRAINING

Besides the cowpea monitoring tour, part of training activities of RENACO, a joint maize-cowpea-sorghum seminar was held at IITA-Ibadan, from 7-19 January, 1991. The objectives of the seminar is discussed and recommendations by the participants of the seminar are described in pages 100 to 102 of this report.

3.6. FINANCIAL ASSISTANCE TO NATIONAL PROGRAMS

In order to facilitate the smooth running of cowpea research activities by Lead and Associate Centers and Technology Adopting Centers, financial assistance was provided as follows upon request and presentation of proforma invoices.

Country	For purchase of material and/or equipment	First payment	Second payment
Senegal	-	412.500 F CFA	375.000 FCFA*
Burkina Faso	-	825.000 F CFA	640.000 FCFA*
Ghana	-	280.320 F CFA (or $1,000.00)	250.000 F CFA* (or $1,000.00)
Mali	-	275.000 F CFA (or FF 5,500)	250.000 F CFA (or FF 5,500)
Cameroon	-	275.000 F CFA*	-
Niger	-	275.000 F CFA*	-
Nigeria	-	$2,000.00*	-
Côte d'Ivoire	145.000 FCFA*	-	-
R.C.A.	2,900 FF*	-	-

* Justification not yet received.

3.7. MISCELLANEOUS

- **Visit of national programs by GLIP-IITA scientists:** Dr. H. Rossel, virologist, visited northern Nigeria in September, 1990 surveying the occurrence of viral diseases. Dr. K.F. Cardwell, GLIP-IITA pathologist, accompanied by Dr. J. Lane, a *Striga* specialist at Long Ashton Research Station at the University of Bristol in England, toured Nigeria, Niger, Burkina Faso and Togo in October, 1990, surveying the *Striga* infestation on cowpea. Drs. H. Rossel, J.B. Suh and G.O. Myers, GLIP-IITA scientists along with the RENACO Coordinator, Dr. N. Muleba, attended the Ghana Annual Maize and Cowpea Workshop in March 1991.

- **List of cowpea cultivars released or about to be released through RENACO efforts:** Cowpea varieties released since 1987 are given on Table 1 and varieties in the pre-extension stage are given on Table 2.

Table 1.

Varieties released by different RENACO national cowpea programs since 1987.

Country/Name of variety	Origin	Areas of Adaptation	Year released (kg/ha)	Quantity of seeds released 1990	Area cultivated in (kg/ha)	Yield potential (kg/ha)	Yield under farmers conditions	Remarks
Benin								
IT82E -32	IITA/Ibadan	Costal Zone	-	-	-	-	-	-
IT81S-1137	-do-	-do-	-	-	-	-	-	-
TVx1850-01F	-do-	Northern Benin	-	-	-	-	-	-
Burkina Faso:								
TVx3236	IITA	300-1000 mm	1987	2.500	250	1.500	800-1000	Pure crop by extension services.
Cape Verde								
KN-1	-	-	-	-	-	-	-	-
Local Santiago	-	-	-	-	-	-	-	-
Ghana								
Vallenga (IT82E-16)	IITA/Ibadan	Northern Ghana	1987	1100	23,000	1,700	800-1200	Good yield potential but low price paid in market
Asontem (IT82E-32	IITA/Ibadan	Southern Ghana	1987	100	29,000	1,700	1000	Good yield potntial but low price paid in market
Guinea Bissau								
IT82E-9	IITA/Ibadan	Northern Eastern region	1988	-	-	-	-	--
Bambey-21	ISRA/Senegal	-do-	-	-	-	-	-	-

Table 1. (Cont'd).

Varieties released by different RENACO national cowpea programs since 1987.

Country/Name of variety	Origin	Areas of Adaptation	Year released	Quantity of seeds released (kg/ha)	Area cultivated in 1990 (ha)	Yield potential (kg/ha)	Yield under farmers conditions (kg/ha)	Remarks
Guinea Conakry:								
IT85 F-867-5	IITA/SAFGRAD	Lower Guinea	1990	600	40	1.000	500	High rainfall zone
IT85 F-867-5	IITA/SAFGRAD	Medium Guinea	1990	700	46	900	500	High Altitude Low temperature
IT83D-338-1	IITA/SAFGRAD	Upper Guinea	1989	500	33	650	350	Guinea savanna zones
IT84S-2246-4	IITA/SAFGRAD	Upper Guinea	1990	800	53	800	500	Guinea savanna zones
Mauritania:								
IT83S-343-5-5	SAFGRAD	Guidimaka	1987/88	25000	1000-200	1.500	500-700	
Suvita-2	SAFGRAD	Attabi	1987	25000	500	1.000	300-400	Drought resistant
KVx256-K17-11	SAFGRAD	Tagaut	1987	25000	500	1.000		Acceptability difficult because of seed color
Nigeria:								
Sampea-7 (IAR-48)	IAR Nigeria	Savanna & forest zones	1987	10000	7500	1500-2500	600	Area cultivated is an estimate. It may actually be more than
Senegal:								
IS86-275	ISRA Senegal	Sahelian	1987	-	20000-30000	2200-2500	600-1100	-
Togo:								
58-146	ISRA	The whole country	1987-88	-	ND	1100-1600	400-1000	Still in pre-release stage in certain zones

Table 2

Varieties released by different RENACO national cowpea programs since 1987.

Country/Name of variety	Origin	Areas of adaptation	Potential areas of cultivation (ha)	Yield under potential (kg/ha)	Yield under farmers conditions (kg/ha)	Remarks
Benin						
IT84S-2246	IITA/Ibadan	Coastal zone	-	-	-	-
IT84D-513	-do-	-do-	-	-	-	-
TVx1999-01F	-do-	-do-	-	-	-	-
Burkina Faso						
KVx30-309-6G	Burkina Faso	300-900 mm	110	1000 en pure 450 en assoc	800 400	These areas of cultivation are those covered by the 1990 0n-farm trials and farmers field which received seeds from our stocks.
KVx61-1	-do-	-do-	350	1500	900	
KVx396-4-4	-do-	300-1200 mm	350	1500 450	900 400	
KVx396-4-5	-do-	-do-	250	1500 400	900 400	
KVx396-18-10	-do-	-do-	-do-	1500 500	400 400	
Cameroon						
IT81D-994	IITA/Ibadan	Sudan & Northern Guinea Savanna	-	1200	400	Extension stage
Cape Verde						
IT83D-442	IITA/Ibadan	-	-	-	-	-
Mississipi	-	-	-	-	-	-
Ghana						
IT81D-1137	IITA/Ibadan	Savanna areas	The whole of Ghana	1700	900	Highly acceptable seed coat color
IT83S-818	IITA/Ibadan	-do-	-do-	1000	650	-

Table 2 (Cont'd-1)

Varieties released by different RENACO national cowpea programs since 1987.

Country/Name of variety	Origin	Areas of adaptation	Potential areas of cultivation (ha)	Yield under potential (kg/ha)	Yield under farmers conditions (kg/ha)	Remarks
Guinea Bissau						
IT83-219	IITA/SAFGRAD					
IT85D-3516-2	-do-					
IT86D-498	-do-					
IT87S-1390	-do-					
IT85-3577	-do-	-	-	-	-	-
IT83D-889	-do-					
TVx309-66	-do-					
IS86-275N	ISRA - Senegal					
IS87-416N	ISRA - Senegal					
Guinea Conakry						
IT84S-2246-4	IITA/SAFGRAD	Lower Guinea	20	1000	500	Insecticide Protection
IT82E-32	-do-	-do-	5	590	400	-
IT86D-1048	-do-	-do-	5	675	400	
IT86D-1056	-do-	-do-	5	600	350	-
IT85F-867-5	-do-	Upper Guinea	5	800	500	-
Mauritania						
IT86V-472	SAFGRAD	Valley/Senegal	-	1600-2000	400-600	All these varieties have been
IT82D-544-4	-do-	-do-	-	1600-2000	400-600	accepted for their bruchid
IT81D-897	-do-	-do-	-	1600-2000	400-600	tolerant characteristics
IT82D-716	-do-	-do-	-	1600-2000	400-600	
IT82D-927	-do-	River valley	-	10000-20000	10000	Interesting for forage production and
TVx1948-MF	-do-	and dams	-	1500	10000	supply of green leaves for
ISRA	-	-	-	1000	5.800	human consumption

Table 2 (Cont'd-1)

Varieties released by different RENACO national cowpea programs since 1987.

Country/Name of variety	Origin	Areas of adaptation	Potential areas of cultivation (ha)	Yield under potential (kg/ha)	Yield under farmers conditions (kg/ha)	Remarks
Niger						
A18-1-1	INRAN-Niger	Low to average rainfall	-	1500	Being evaluated	Earliness appreciated by farmers. Also appreciated for grain quality.
A73-1-2	-do-	"	-	1200	"	
KVx30-309-6G	Burkina Faso	"	-	1500	"	
KVx100-2	-do-	-	-	1500	"	
Nigeria:	IITA/Ibadan	Sudano-Guinea savanna	Sudano-Guinea & savanna & forest zone	2500	600	-
IT81D-994	-do-	-do-	-do-	-do-	-do-	-
Togo:						
TVx 1850-01E	IITA/Ibadan	The whole country	-	1000-1300	600-1000	Yield of all varieties are highly variable, depending on the region and crop season as well as cultural practices, especially for IT81D-985.
IT81D-985	-do-	The whole country	-	1000-2000	900 en milien humide	
58-146	ISRA/Senegal	The whole country	-	1100-1600	400-1000	
IT83S-818	IITA/Ibadan	Région des plateaux	-	1000-1300	-	Potential cultivated areas come under the extension services unit. None available yet.
IT82E-16	-do-	et Maritime	-	1400-1700	-	

SECTION C.

I. JOINT SEMINAR FOR AGRONOMISTS

The West and Central Africa Sorghum, Maize and Cowpea SAFGRAD Networks organized a seminar for research agronomists at the International Institute of Tropical Agriculture (IITA), Ibadan 7-19 January, 1991. The objectives of the seminar were :

(i) improvement of research capabilities of research agronomists through exchange of ideas,

(ii) elucidation of the major constraints to agricultural production in the sub-region with a view to identifying areas that require research emphasis, and

(iii) understanding of the concept of low input technology with a view to identifying appropriate technologies compatible with farmers needs and requirments and the sustainability of agricultural production and the ecosystem.

The seminar was attended by 20 national program research agronomists from 13 countries and 13 resource persons from IITA, ICRISAT and some national research institutions. Talks were given by subject-matter specialists from both the national and international research systems. An interesting feature of the seminar was that emphasis was placed on discussion. This enabled participants and presenters to exchange views on new concepts and how to approach seemingly difficult problems in the sub-region. One thing that came out clearly was the similarity of problems across the sub-region.

Highlights and recommendations

1. A strong collaboration among agronomists, breeders, extensionists and other scientists is necessary if farmers' needs are to be addressed.

2. While selection under farmers' conditions i.e. under no-tillage or minimum tillage and low input, (including soil fertility) is useful in alleviating farmers' production constraints, it appears to be difficult to implement and to attain the goals set ahead. This is explained by the high heterogeneity of tropical conditions (soil especially) exhibited by high C.V.s under no-inputs. One way to circumvert this difficulty is to screen parents involved in crosses and promising lines obtained from such crosses at the preliminary or advanced yield test stages under farmers' and improved conditions.

3. Tied-ridging is an efficient method for soil and water management, but its efficiency depends on the crop, rainfall intensity and pattern, climate and soil type.

4. Lack of organic residue for recycling due to stubble removal to feed livestock is a serious constraint in the semi-arid zone. To address this problem, research on alley cropping was suggested.

5. Since most farmlands are intercropped, legume cultivars adapted to intercropping situations should be identified. More work should be done on fertilizer use in intercropping situations. Spatial arrangement of the component crops and methods of application of mineral fertilizer are outstanding research issues.

6. Given the determination of SAFGRAD to improve food grain production and productivity in the sub-region, the need to better involve agronomists in its activities is strongly recommended.

7. Many factors hamper the activities of agronomists. Among them are (i) lack of training opportunities and technical information, (ii) lack of adequate infrastructure and financial support and (iii) poorly maintained and sometimes badly situated research stations.

8. Research should be further intensified in the following areas : on-farm experimentation, maintenance of soil fertility, water conservation, effective utilization of rock phosphate, and breeding crops for stress tolerance/resistance.

II. Joint Workshop

A joint maize, sorghum and cowpea workshop was held at Niamey Niger, 8-14 March, 1991. The workshop depicted the efforts made by the West and Central Africa maize, sorghum and cowpea networks and SAFGRAD Coordination Office to establish and maintain effective communication and information exchange among the networks. In order to expand the dimension of the workshop as a Pan-African effort, the East African Sorghum and Millet Network (Network Coordinator and some scientists) were invited. Also invited were the Pan-African *Striga* Control Network, "Institut du Sahel" and others.

The objective of the workshop was to bring together national and international scientists working in different crops and various disciplines to get to know one another and exchange scientific information, new technologies developed and experiences gained during the 4 years of networking.

The workshop was organized in three components as follows:

i) First plenary session: This session was under the supervision of SAFGRAD Coordination Office. Distinguished invited guests addressed participants and discussed with them their views on:
- New frontiers on food grain research in the 1990's;
- Integrated approach on *Striga* control in Africa;
- Soil fertility maintenance and regeneration in Africa;
- Overview on maize, cowpea, sorghum and millet research in semi-arid Africa.

ii) **Second plenary session**. This session was under the supervision of the network coordinators. It consisted of the presentation of up-to-date scientific information. To this effect 12 original papers which were submitted and approved by an Ad-hoc committee for each network, were presented and discussed alternately by the maize, cowpea and sorghum scientists.

iii) **Separate session**. The different networks met separately, to discuss their specific problems. The session was made up of four sub-components as follows:

- **Up-to-date scientific information**:This was a continuation of the second plenary session. Papers presented were specifically on the respective network crop;

- **Country reports**: Country reports were given along the format requested by each Network. For instance the presentations in the cowpea network emphasized progress report for the 1989 and 1990 cropping seasons. In the Maize Network, presentation delved into production trend since 1986 and on views of each country on the activities or impact of the Network.

- **Election of the new Steering Committee membership**

- **Formulation of regional trials.** The cowpea network furmulated five types of regional trials namely (i) Adaptation to transition zones, (ii) Adaptation to Sahelian and Sudanian zones, (iii) Adaptation to northern savanna zones, iv) *Striga* resistance, and v) Observation trials. Eighty-three sets of these trials were requested on-the-spot. The Maize Network agreed to continue with the two types of trials: (i) RUVT Early and (ii) RUVT Extra-Early. Eighty sets were requested by 17 countries.

Workshop attendance

A total of 150 national and international scientists and administrators attended the workshop. Among them were 44 and 49 maize and cowpea scientists, respectively. A total of 35 original scientific papers were presented by maize (20) and cowpea (15) scientists. In general, the papers presented and country reports demonstrated that new technologies were being generated for the sub-region. These enabled the formulation of the 1991/92 regional trials and observations trials for the Cowpea Network and the 1991 trials for the Maize Network. Judging from the number and quality of the papers presented at the workshop and the great interaction between the networks, the participants were unanimous in recommending that the biennial inter-networks worshops should be encouraged.

III. Major Problems Encountered

The Maize and Cowpea Collaborative Research Networks for West and Central Africa have continued to make remarkable progress in addressing the problems facing maize and cowpea production in the sub-region. Appropriate technologies are emerging from collaborative research, IITA research efforts and the regional trials and other network activities continue to ensure exchange of germplasm and other technologies among the various countries.

In all the network-member countries, contemporary socio-economic factors make expectations from agricultural research greater than ever before. The Networks can respond effectively to this if the following two major constraints can be alleviated.

1. Inadequate Pool of Scientists

Both networks are still handicapped by the fact that virtually all the member-countries do not have the basic minimum or critical mass of scientists to carry out farmer-oriented research. Yet, the researchable production constraints are many and complex, therefore, demanding skill and originality of approach. A vigorous higher degree training program is absolutely required preferably with such trainees handling outstanding problems of the sub-region as thesis subjects.

2. Need for better research management

Agricultural research is obviously a human endeavour. For it to fluorish, it therefore requires the so-called four "I's" prerequisites namely (i) Inovation, being the efforts of qualified, skilled and motivated manpower, (ii) Inputs, (iii) Infrastructure, and (iv) Incentive to attract and keep qualified and devoted research and extension workers. All these should be taken into account when budgets are drawn or decision taken by policy makers on issues like food production and importation including input costs and availability.

While appreciating the efforts made in the last 3-4 years in recruiting some scientists and assigning them to crop commodity and/or specialized research disciplines, a lot more is still to be done in order to attain tangible results. Investments by national governments of West and Central Africa is grossly inadequate to support agricultural research in particular and agricultural development as a whole and thus does not facilitate innovation This has created a vicious circle in all the participating SAFGRAD member countries since well trained and devoted scientists cannot be easily recruited, yet the few available are demoralized because of low remuneration and gloomy future prospect.

At this point in time, something has to be done. The attention of donor agencies should be drawn to seek ways and means for the elimination of the long-time existing "vicious circle". Governments of member countries ought to be encouraged to budget adequate resources to motivate hard work from qualified scientists, extension workers, agricultural producers, etc. All these are crucial in ensuring the sustainability of not only good quality research, but also a prosperous agricultural production and productivity.

IV. Recommendatioms for Improvement and Follow-Up Activities for The Year

Although the Project is scheduled to terminate on 31st August 1991, the chances are high that the donors will provide funds to extend it till 31st December 1991 in order to ensure that activities do not terminate in the middle of the cropping season. All the collaborative research projects and regional trials will therefore be implemented. Visits will also be conducted by the Coordinators and members of the Steering Committee to national programs for project evaluation and consultation.

SAFGRAD Phase II is scheduled for final evaluation by the donor (USAID) in the first half of 1991. It is hoped that the problems of critical mass of trained specialists in maize and cowpea research will be appreciated. The success of any follow-on phase of the Project will depend largely on a serious attempt to correct this anomaly. The Networks will welcome being involved in the identification of training positions and of relevant, interesting, and rewarding areas of research in order to tailor the higher degree training to the most critical needs.

The establishment of an On-Farm research component in every national program is essential for the refinement of technologies developed on-station and the delivery of appropriate technologies to the farmers. It is recommended that the follow-on phase provides mechanism to address this area of research at bilateral level. Experience in the present phase has shown that impact is easier to demonstrate if this activity is integrated with the national programs rather than the network.

1991-05

MAIZE AND COWPEA COLLABORATIVE RESEARCH NETWORKS FOR WEST AND CENTRAL AFRICA, ANNUAL REPORT 1990/91

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