WEST AND CENTRAL AFRICA MAIZE NETWORK (WECAMAN)

ANNUAL REPORT 1995/1996

Funded by:

United States Agency for International Development (USAID)

Grant No LAG-4111-G 00 - 3042-00 R&D/AG

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Preface

This annual report covers the activities of the West and Central Africa Maize Network (WECAMAN) during the period October 1, 1995 to September 30, 1996.

During the review period, the activities of the maize network approved by the Steering Committee during its meeting in IITA-Ibadan, Nigeria, 15-16 November, 1995 were implemented by national programs of member countries.

Glossary of Acronyms and Abbreviations

CID	Crop Improvement Division
CIDT	Compagnie Ivoirienne de Développement des Textiles
CIMMYT	Centro International de Mejoramiento de Maiz y Trigo
CRI	Crops Research Institute
CRPA	Centre Regional Promotion Agro-pastorale
IARC	International Agricultural Research Center
ICD	International Cooperation Division
ICRISAT	International Crops Research Institute for Semi-Arid Tropics
IDESSA	Institut des Savanes
IER	Institut d'Economie Rurale
IITA	International Institute for Tropical Agriculture
INERA	Institut d'Etudes et de Recherches Agricoles
INRAB	Institut National de Recherches Agricoles du Benin
IRA	Institut de la Recherche Agronomique
NARS	National Agricultural Research Systems
OIC	Opportunities Industrialization Center
OAU	Organization of African Unity
RRPMC	Regional Research Program for Maize and Cassava
SAFGRAD	Semi-Arid Food Grains Research and Development
SARI	Savanna Agricultural Research Institute
STRC	Scientific, Technical and Research Commission
USAID	United States Agency for International Development
WARDA	West Africa Rice Development Association
WECAMAN	West and Central Africa Maize Network

Acknowledgment

The West and Central Africa Maize Network gratefully acknowledges the support from the Government and people of Côte d'Ivoire. Special thanks go to the Ministry of Higher Education and Scientific Research for assisting in providing land and other facilities at Ferkessedougou and Sinematiali for maize research activities. The excellent cooperation of the Director General of the "Institut des Savanes" (IDESSA), heads of research stations and departments contributed significantly to the successful execution of network activities.

The network is grateful to the Director of INERA, Burkina Faso for offering land and research facilities at Kamboinse for the resident research of the Coordinator. The technical support of Dr. Hema Idrissa at Kamboinse is also acknowledged.

The support of the Directors of agricultural research in the National Agricultural Research Systems (NARS) of the network member countries is gratefully acknowledged. The interest and active participation of researchers of the national maize programs contributed in no small measure to the successful operation of the network.

The network is grateful for the office facilities and logistic support provided by WARDA. Prompt and effective administrative and technical backstopping from IITA headquarters at Ibadan, Nigeria and IITA - Bouaké, played a significant role in the successful implementation of the programs of the network.

Several IARCs and organizations namely CIMMYT, ICRISAT, OIC and OAU/STRC SAFGRAD co-operated fully with the network and are gratefully acknowledged.

The activities presented in this annual report were made possible through the support provided by the Office of Agriculture, Bureau for Research and Development, US. Agency for International Development, under the terms of grant no. LAG-4111-G-00-3042-00.

Bouaké, October 1996

Baffour Badu-Apraku
Coordinator, Maize
Network

Declaration

Mention of a particular pesticide, chemical or product in this document does not imply endorsement of, or discrimination against any manufactured products by WECAMAN.

The opinions expressed herein are those of the author and do not necessarily reflect those of USAID.

WECAMAN Personnel

Principal Staff

B. Badu-Apraku, Network Coordinator

Support Staff

Elisabeth Yao Affoué, Bilingual Secretary

Soro Siaka, Driver mechanic

Coulibaly, Field assistant

Yves Sekongo, Field assistant

Sekongo Bakary, Field assistant

Dossou Yagouba, Technician

Koffi Bernard, Site supervisor

EXECUTIVE SUMMARY

During the period 1 October, 1995 - 30 September, 1996, the West and Central Africa Maize Collaborative Research Network (WECAMAN) made significant progress towards the attainment of its strategic objectives. The national maize programs of Cameroon and Burkina Faso nominated for the first time extra-early varieties developed in the two countries for the Regional Uniform Extra-early Variety Trial. The results of the RUVT-early, across 17 locations in West and Central Africa showed Syn E_2, a variety developed by Cameroon, as the highest yielding entry. It was noted that in the RUVT-extra early, there was no significant differences in the yield of the best entry, TZESR-W x GUA 314, the reference entry TZEE-W-SR BC_5 and CSP-SR x TZEE-Y, an experimental variety developed by Cameroon maize program. Two local maize varieties T^{12} BD and Kpabbridjak were identified in Benin as tolerant to *Striga* under artificial infestation in pots. Also, several *Striga* resistant open pollinated varieties and hybrids have been identified in Ghana.

Several quantities of seed of released maize varieties were produced in Cameroon, Togo, Benin, Burkina Faso, and Mali through the community seed production projects funded by WECAMAN and revolving funds have been established in each country. Also, several farmers were trained in the techniques of seed production.

Mr N'Tji Coulibaly, a member of the WECAMAN Steering Committee and the national maize coordinator of Mali was honoured by the Malian President who decorated him with the National Medal of Honour. This was in recognition of maize production increases in Mali as a result of an effective technology transfer system. Also, the cotton extension agency, CMDT and the government of Mali have increased their contribution to the maize research program in that country.

Three main activities were carried out in an effort to strengthen the research capability of the national maize programs. These included an advanced computer course, a monitoring tour and a technician training course. An advanced computer course was organized for selected breeders and agronomists from West and Central Africa by WECAMAN in collaboration with the Group Training and Biometrics Units of IITA from 11-21 June, 1996 at the Rural Management Training Institute (ARMTI) in Ilorin, Nigeria. The course upgraded the skills of national scientists in the analysis and interpretation of complex statistical data, selection of appropriate statistical methods for data analysis and in the use of the GENSTAT package.

A monitoring tour involving eight participants from network member countries was successfully organized by WECAMAN to Ghana and Burkina Faso from 15 - 27 September, 1996.

A technician training course involving eight participants from each of the WECAMAN member countries is presently going on at Ferkessedougou and it is expected to end on 22 November, 1996.

In an effort to promote the transfer of technologies in network member countries, WECAMAN funded on-farm tests and demonstrations in Côte d'Ivoire, Benin, Mali and Togo in 1995. Through this project, several varieties have been identified and are either at the pre-

release stage or have already been released. Also, following a workshop on extension material development, WECAMAN allocated funds to each member country in 1996 for the publication of extension manuals.

1. INTRODUCTION

The maize network with backstopping from IITA has during the past three years, established an effective collaborative research system with the active participation of NARS of 8 countries in West and Central Africa. The network has significantly improved the professional capacity and confidence of participating national scientists to carry out maize research aimed at alleviating regional production constraints. The network has allowed research responsibilities to be assigned on competitive basis among NARS scientists, thus minimising duplication. Through the collaborative research activities, national scientists have not only improved their research skills, but have also become a source of technology development. New streak resistant, *Striga* and drought tolerant high yielding maize varieties and improved agronomic practices have been developed by the network member countries. The network is through biennial workshops, special purpose seminars, technician training courses and monitoring tours, serving as a vehicle for the exchange of germplasm, information and technology.

The maize network has six strategic objectives. These are to:

i) improve research/extension farmer linkages for effective adoption of maize technologies developed by the network.

ii) develop sustainable seed production and distribution systems in West and Central Africa.

iii) develop maize varieties that possess resistance/tolerance to the major biotic and abiotic stresses that limit maize production in the sub-region.

iv) develop suitable agronomic practices to enhance increased maize productivity and production

v) develop and promote alternative uses of maize

vi) enhance the capacity within the network to carry out a collaborative research program with minimum outside support

This annual report discusses the progress made by the maize network towards the attainment of the strategic objectives during the period 1 October, 1995 to 30 September, 1996.

2. ACHIEVEMENTS OF THE MAIZE NETWORK IN 1995/96

The activities of the network fall into three main categories as follows:

- Activities which focus on technology transfer and dissemination of proven technologies. These are reported in Sections 2.1 and 2.2

- Research activities which are undertaken by certain national programs as part of the regional research undertaken by the network (refer Sections 2.3 - 2.5)

- Activities concerning capacity building in national programs and the related further development of regional research efficiency and networking (refer Sections 2.6 and 2.7).

The major achievements of the maize network during the period under review were as follows:

2.1 Promotion of technology transfer

Technology transfer is recognized as a major weakness within the National Agricultural and Extension Research Systems (NARES). WECAMAN has three strategies for promoting technology transfer. These are (i) strengthening researcher-extensionist-farmer linkages, (ii) on-farm tests and demonstrations using promising technologies in the pipeline in network member countries, and (iii) ensuring regional spill-over of promising technologies in the pipeline through information exchange activities such as seminars and group training sessions as well as monitoring tours.

a) *Strengthening researcher-extensionist-farmer linkages*

WECAMAN has since 1993 allocated more resources and devoted efforts towards strengthening researcher-extensionist-farmer linkages in member countries in order to foster adoption of improved technologies. The following activities were organized by the network during the period under review in an effort to strengthen researcher-extensionist-farmer linkages within the respective countries:

i) *Annual maize workshop within member countries*

Annual maize workshops were organized in Kumasi and Nyankpala in Ghana during the period under review. These involved researchers, extensionists, policy makers and farmers. The objective was to review research findings, grower recommendations and agricultural policies. An amount of $2000 has been allocated to Benin in support of the maize workshop to be organized in Benin towards the later part of 1996. An annual maize workshop is also planned in Togo during the later part of 1996.

ii) *Planning sessions*

This involved researchers, extensionists, farmers and non-governmental organisations. The objective was to establish research-extension-farmer linkages so that the three bodies could

influence the research agenda of the respective network member countries. Planning sessions were held in Cameroon, Ghana, Mali while an open-day was held in Burkina Faso.

iii) *Publication of hand books on maize for farmers and extensionists*

A course on the development of extension manuals and farmer handbooks was organised for two participants each from the WECAMAN member countries in 1995 in Kumasi, Ghana. During the workshop prototype extension manuals were prepared by each participant and participants were asked to adapt them to the conditions in their respective countries for publication with the support of WECAMAN. An amount of $16,000 was allocated by WECAMAN in 1996 for the publication of the manuals with the technical assistance of the Training and Materials Development Unit (TMU) of IITA. So far extension manuals have been submitted by Togo, Burkina Faso and Ghana for publication and distribution after technical editing by the TMU. The manuals from the other countries are being finalised for publication.

b) ***On-farm tests and demonstrations***

A number of technologies have been developed or identified through network's lead centers, the Coordinator's resident research, IITA and CIMMYT. These technologies have been made available to network member countries for national adaptive trials and demonstrations.

On-farm tests funded by WECAMAN were conducted by Côte d'Ivoire, Benin, Togo and Mali during the period under review (**Table 1**).

Côte d'Ivoire

Six varieties comprising 3 extra-early (CSP-SR BC5, TZEE-W-SR BC_5, TZESR x Gua 314) and 3 early varieties (Kamboinse 88 Pool 16 DT, TZE Comp 4, DMR-E-SR-Y) were tested on-farm in twenty-one trials at Nielle, Ferkessedougou, Korhogo, and Boundiali in northern Côte d'Ivoire.

It was observed that the local checks varied from one farmer to another and were in all cases too late (120 days to maturity) for the early (90-95 days to maturity) or extra-early group (75-80 days to maturity).

There were no significant differences among the varieties in terms of grain yield. However, the farmers preferred CSP-SR BC_5 due to its desirable taste and colour.

Table 1. **On-farm tests conducted by selected network member countries in 1995**

Countries		Varieties tested on-farm	N° of farmers
Côte d'Ivoire	Early	Kamb 88 Pool 16 DT	24
		TZE Comp 4	
		DMR-E-SR-Y	6
	Extra-early	CSP-SR6	
		TZEE-W-SR	6
		TZE-SR x Gua 314	
Benin	Extra-early	TZEE-SR-W	_
	Early	Kamb 88 Pool 16 DT	_
		DMR ESR-W	_
Mali	Intermediate	Sotubaka	
	Early	Niéléni	40
	Extra-early	Appolo	
Togo	Early	Amen	8
		AB II	

The preference for the varieties at the different locations were as follows:

Korhogo	_	CSP SR BC5
Nielle	_	CSP SR BC5 and DMR-ESRY
Bouandiali	_	TZE Comp 4 and DMR-ESRY
Ferkessedougou	_	TZE Comp 4 and DMR-ESRY

Benin

On-farm tests involving TZEE-SR-W and Kamboinse 88 Pool 16 DT were conducted. Both varieties yielded more than the local varieties and were appreciated for the high yield and good taste.

Mali

Three improved varieties (intermediate, early and extra-early) were compared with local varieties in farmers field at 3 locations in forty farms.

The varieties Sotubaka, EV 8422 SR, Nieleni (DMR-ESRY) and Appolo (Suwan I-SR) confirmed their good adaptation and superior performance over local checks at all the 3 test locations. These varieties are at the pre-release stage in some areas and at the release stage in others.

Togo

Two improved varieties, Amen and AB II were evaluated on-farm along with the local check. Eight farmers were selected, trained in on-farm testing and used as collaborators.

The analysis of the results of the study revealed no significant differences in the grain yield of the varieties evaluated (**Table 2**).

The economic analyses showed that with a cost of production of 61625 F, a farmer could make a profit ranging from 1875 F in Bafilo East to 79625 F in Koukou zone if the improved varieties evaluated were adopted (**Table 2**).

Table 2. **Grain yield of maize varieties evaluated on-farm in two regions of Kara, Togo**

Sector	Southern Sector	Zone	Grain yield (kg/ha)			Mean grain yield of zones (kg/ha)
Assoli	Bafilo	Bafilo Est	1280	1450	1080	1270
	Bafilo	Bafilo Centre	1910	2310	2120	2113
Doufelgou	Défalé	Bega Ouest	3330	1590	1160	2027
	Siou	Koukou	3300	2930	2250	2827
Regional mean grain yield			2455	2070	1652	2059

A field day was held on 25 October, 1995 at Koukou and was attended by several extension officials and over 100 farmers.

Amen was identified by the farmers as the most promising variety because of the large ear size and its good tip cover. In addition, a socio-economic analysis showed high profit margins under improved agricultural practices with early varieties such as Amen and AB II as they afford the opportunity for intercropping with cowpea.

Farmers around the on-farm tests' sites have started requesting for seed of Amen and efforts are being made to satisfy the demand in 1996. So far, 1.0 ton of maize has been made available for sale to farmers for promotion of the new variety. Also, the new varieties would be tested in other areas of Kara region and in the Sudan-savanna zone in order to improve the adoption of the new varieties.

2.2 Development of sustainable seed production and distribution system in West and Central Africa

Several maize varieties have been released in network member countries through the network's efforts. However, the adoption of the improved varieties is not as high as desirable partly due to lack of well-organised seed industry in some member countries. Therefore, making available seed of the improved varieties is one of the potential means of ensuring high adoption of the released varieties and high and stable yield.

The objective is to train farmers in techniques of maize seed production, strengthen the capacity of seed producers to produce good quality seed, encourage NARS scientists to work with selected farmers and non-governmental organisations in the development of on-farm

community level seed production schemes. This is an effort to promote the diffusion and utilisation of seed of improved varieties and produce and maintain breeder and foundation seed of released varieties. A total amount of $12500 was allocated to Benin, Cameroon, Togo, Mali and Burkina Faso in 1995 in support of this activity.

The quantities of seed produced by the network member countries involved in this activity are presented in **Tables 3-7** while the number of farmers trained in the techniques of seed production is shown in **Table 8**. In Mali, a total of 1.5 tons of seed of Sotubaka and Niélieni was produced from 0.2 ha of land. All the seed produced by the collaborating farmers were sold to other farmers.

The strategy of network members involved in the community level seed production has been to provide technical advice, seed and other inputs to the collaborating farmers. At harvest, the farmers are required to payback either with seed or money from their seed sales. Through this arrangement, the member countries have established revolving funds to ensure the sustainability of this activity and also to reach increasing number of farmers each year.

Table 3. **Quantity of breeder seed produced in network member countries in 1995**

Countries	Names of varieties	Quantity of seed produced (kg)
Burkina Faso	KPB	3
	KPJ	3
	TZEE-WSR	3
	REJ	3
	KEB	3
	DMESR-W	3
	KB 90 Pool 16 DT	3
Cameroon*	CMS 8501	
	CMS 8704	
	CMS 8806	
	CMS 9015	
	TZEE-W-SR	
Benin*	TZEE-W-SR	
	DME SR-W	
	Kamb 88 Pool 16 DT	
Togo*	Ikenne 8149 SR	
	A B 11	
	Amen '	
	TZESR-W x SUG 314 BC2	

* Adequate quantities of breeder seed of the varieties listed were produced and made available for foundation seed production but quantities produced are not available.

Table 4. **Quantity of foundation seed produced in Togo in 1995**

Location	Variety	Area (ha)	Quantity of seed (kg)	Maturity group
Adeta	Ikenne 8149 SR	0.25	300	Early
Adeta	AB - II	0.5	450	Early
Davie	Amen	0.5	240	Early
Davie	TZEESR-WxGua 314	0.5	25	Extra-early
Total		1.75	1115	

Table 5. **Quantity of foundation seed produced in Burkina Faso in 1995**

Varieties	Location	
	Kamboinse (kg)	Gampela (kg)
KPB	50	450
KPJ	50	120
KEJ	30	400
KEB	30	120
DMESR-W	50	700
Kb 90 Pool 16 DT	50	_
Total	260	1790

Table 6. **Quantity of seed produced on-farm in 1995 in Cameroon under the community seed production scheme**

Varieties	N° of farmers	Land area (ha)	Quantity of seed produced ((kg)	Quantity of seed collected from farmers (kg)
CMS 8704	4	2	5600	1800
CMS 8501	2	2	6400	2100
CMS 9015 (Pool 16 DT)	10	5	10500	3500
CMS 8806 (DMR ESRY)	2	2	4200	1400
TZEE-W-SR	8	8	8500	2500
Total	26	14	35200	11300

Table 7. **Quantity of seed produced on-farm in Benin in 1995 under the community seed production scheme**

Varieties	Sites	Total maize collected (kg)	Grain production (kg)	Amount of seed produced (kg)
DMR-ESRW	Pade	39600	1584	37100
	Ouaga	7275	1455	6000
	Pehunco			
TZEE-W SR	Angaradebou	3460	1065	2800
	Tempegre	4170	1390	3500
Total		54505	5494	49400

Table 8. **Number of farmers trained in seed production in WECAMAN member countries in 1995**

Country	N° of villages	N° of farmers/seed producers
Cameroon	7	26
Burkina Faso	3	205
Benin	_	49
Mali	5	100

2.3 Development of maize varieties that possess resistance/tolerance to the major biotic and abiotic stresses that limit maize production in the sub-region.

The cultivation of maize varieties that mature in about 90-95 or 75-80 days is a very attractive option for farmers in the Sudan savanna and also in the northern Guinea savanna under conditions where late onset or early cessation of rains has reduced the effective rainfall period.

In these ecologies drought and the parasitic weed, *Striga hermonthica* are major constraints to increased maize production and productivity.

Cameroon, Ghana, Burkina Faso and Côte d'Ivoire have been assigned on a competitive basis research responsibility for the development of appropriate varieties for the network member countries. These lead centers and the network coordinator have screened and identified promising early maturing drought tolerant and *Striga* resistant materials and have started incorporating them into existing early maize populations or initiated the development of new drought tolerant and *Striga* resistant and early maturing maize populations which would serve as the source of future drought tolerant varieties. Also, drought tolerant and/or *Striga* resistant varieties have been developed from crosses between the promising materials. Through this program, Cameroon, Togo and Burkina Faso contributed entries for the 1995 extra-early and early Regional Uniform Variety Trials (RUVT).

The results of the RUVT-early across 17 locations in West and Central Africa showed Syn E_2, a variety developed by Cameroon, as the highest yielding entry (**Table 9**). It was also interesting to note that in the RUVT- extra early, there were no significant differences in the yield of the best entry, TZESR-W x Gua 314, the reference entry TZEE-W-SR BC_5 and CSP-SR x TZEE-Y, an experimental variety developed by Cameroon maize program (**Table 10**). It should be noted that 1995 was the first time that national programs (Burkina Faso and Cameroon) nominated entries for the RUVT-extra-early. All the entries for the RUVT extra-early had before then come from the resident research program of the Network Coordinator. Also, the outstanding performance of Syn E_2 and CSP-SR x TZEE-Y and other entries from the NARS indicates that the research capability of the NARS has tremendously improved.

Table 9. **1995 RUVT-Extra-Early at 9 locations in 7 countries: Means for grain yield and other agronomic characters***

PEDIGREE	Grain yield (kg/ha)	DYS SILK (no.)	PL HT (cm)	EHT (cm)	RL (%)	SL (%)
TZESR-W X GUA 314 BC	4116	49	171	81	13.1	6.0
CSP-SR X TZEE-Y	4040	49	176	84	16.7	4.9
TZEE-W-SR BC_5	3922	47	172	83	16.9	7.9
KEB	3782	48	168	76	22.7	6.7
KEJ	3776	46	155	65	15.4	3.7
CHECK	3577	42	161	77	13.6	6.7
CSP-SR BC_5	3550	46	153	63	16.2	3.8
CSP X LOCAL RAYTIRI	3497	46	167	73	14.5	9.2
TZEF-Y	3396	46	167	77	15.9	9.2
TZEE-Y BC_5	3361	46	170	77	10.0	11.0
GRAND MEAN	3702	47	166	76	15.5	6.9
CV	18	3	7	13	75.7	74.4
LSD	301	1	5	4	5.2	2.3
SED	161	0	3	2	2.8	1.2

* PLHT = plant height; EHT = ear height; RL = root lodging; SL = stalk lodging

Table 10. **1995 RUVT-Early at 17 locations in 7 countries: across location means for grains yield and other agronomic characters***

PEDIGREE	Yield (Kg/ha)	DYS HT SILK	PL (cm)	EHT (cm)	RL (%)	SL (%)
SYN E2	4700	57	173	90	7.8	6.6
TZE COMP.3 C1	4665	53	173	84	5.9	5.4
TZE COMP.4 DMR BC2	4639	54	178	85	6.2	3.7
TZE COMP.4 C2	4599	54	173	79	6.3	3.1
KAMBOINSE 88 POOL 16	4498	53	169	81	7.1	5.6
FARAKOBA 90 POOL 16	4412	52	171	80	8.5	7.2
AB 11	4335	57	193	104	9.4	7.2
DORKE-SR	4272	56	189	94	10.1	7.8
KPB	4117	52	164	74	8.7	5.7
NAES POOL 16 DT	4099	52	167	78	9.4	6.0
KPJ	4054	50	168	75	10.6	7.3
BDP-SR BC5	4029	54	189	100	10.7	8.5
CHECK	3905	51	165	118	9.0	6.8
MAKA-SR BC5	3804	54	177	87	11.7	12.3
GRAND MEAN	4295	53	175	85	8.7	6.7
CV	18	4	8	18	88.4	84.3
LSD	291	1	5	6	2.9	2.1
SED	135	0	2	3	1.3	1.0

* Refer to Table 9

Field evaluation in Ghana in 1995 revealed that some Ghanaian hybrids possess good levels of resistance to *Striga*. These included hybrids GH 110 - 28, GH 110 - 88, GH 132 - 28 (all QPM) and GH 22 x 1368 x 5012 and GH 20 x 1368 x 5012 (both normal maize). The following IITA open pollinated and hybrid varieties were also identified as *Striga* resistant: STR - W/Y and ACR 93 Pop 49 STR - A, 9143 - 13, 9147 - 3 and 9145 - 11. These materials would be made available to network member countries for incorporation into their breeding programs.

A survey conducted in Kara and Savanna regions of Togo has led to the identification of two local maize varieties TI2 BD and Kpabridjak which have been found to be tolerant to *Striga* under artificial infestation in pots. These local varieties could be good source materials for breeding for *Striga* resistance when the performance is confirmed under field conditions.

2.4 Development of suitable agronomic practices to enhance maize productivity and production

There is a need to identify appropriate practices for some of the major determinants of maize yield in the savanna zone of West and Central Africa, namely soil nutrient supply and optimum plant density. Research has demonstrated the importance of legumes in soil fertility maintenance, weed suppression and crop yield sustainability. There is a need to break the continuous maize cropping cycle through the use of suitable legumes. Rotation crops can also be selected for reducing the *Striga* seed bank. Maize varieties suitable for intercropping and relay cropping are needed.

The lead centres for this project are Burkina Faso, Nigeria, Togo, Cameroon, Mali, Benin and Cameroon.

The progress made by the lead centers in developing suitable agronomic practices that could enhance maize productivity and production in the respective countries in 1995 was as follows:

- Screening of trap crops *in vitro* for *Striga* control by Benin scientists has revealed that *in vitro* stimulation of *Striga* seed germination was better with peanut varieties RMP 12, RMP 91 and 69-101. The cowpea variety 90-K-56 has been found to be effective as a trap crop under artificial infestation. The effectiveness of the identified trap crops in *Striga* control is being confirmed under field conditions in 1996.

- Maize-groundnut association study in Benin has established that the highest grain yields were obtained when a maize row was associated with 2 rows of groundnut.

- Studies on time of N application on early and extra-early maize varieties in Benin have established that N should be applied at planting time and 15-22 days after planting for the extra-early varieties and 28-30 days after planting for early varieties in order to maximise grain yield.

- Studies on the response of extra-early, early and intermediate varieties to locally available fertilisation materials in Burkina Faso have established the best formulation to be 300 kg/ha of Burkina phosphate, 75 t/ha of organic matter and 50 kg/ha of urea. This is equivalent to 100 kg/ha of NPK and 50 kg/ha of urea.

- The results of the 2-year study on maize-legume intercropping in Côte d'Ivoire have established that the effect of different legumes (groundnut, cowpea and soybean) on maize were similar and that the maize performed equally well when intercropped with groundnut, cowpea or soybean. The best date of planting depends on whether one is more interested in the maize or the legume production. If the objective is to produce more maize, then the maize and legume could be sown at the same time or the maize could be sown two weeks before the legumes. On the contrary, if the interest is in the legume, then it would be advisable to plant the legume first. Planting of the legume about two weeks before the maize was found to be better than planting of the maize four weeks after the legume.

- Studies by Togo and Burkina Faso on the use of *Parkia biglobosa* pods for *Striga*

control has led to the following conclusions:

(a) There exists germination inhibitors for *Striga* seeds in macerations obtained from *Parkia biglobosa* pods

(b) Concentrated macerations fully inhibit *Striga* seed germination

(c) In some field trials, use of macerations for *Striga* control in a maize crop was detrimental to maize growth and grain yield apparently because of phyto-toxity

As a result, further research is needed to refine field applications in respects of timing and amount of *Parkia* seed extract applied.

2.5 Development and promotion of alternative uses of maize

Evaluation of available released improved maize varieties in Mali for baking by the Ministry of Agriculture in collaboration with national scientists and bakers have concluded that an acceptable bread could be prepared from a composite flour comprising 15% of maize and 85% of wheat flour.

The efforts of the national maize program of Mali has resulted in increased industrial utilisation of maize. As a result of the high consumer acceptance (87%) of the French bread baked with 15% corn flour (20 F CFA lower in price per baguette compared to 100% wheat flour), the Finance Ministry plans to gradually withdraw subsidies on a part of the imported wheat flour. It is anticipated that 50,000 tons of maize would be needed to supplement the wheat flour for bread baking.

Mr N'Tji Coulibaly, a member of the WECAMAN Steering Committee and the national maize coordinator of Mali was honoured by the Malian President who decorated him with the National Medal of Honour. This was in recognition of maize production increases in Mali as a result of effective technology transfer system. Also, the cotton extension agency, CMDT and the government of Mali have increased their contribution to the maize research program and it is anticipated that maize production in Western Mali would be intensified by increased technology transfer efforts.

2.6 Enhancement of the capacity within the network to carry out collaborative research program with minimum outside support

The advances made in improving the research capacity and capability within the network were the following:

(i) *Advanced computer course for breeders and agronomist*

This course was organized for selected breeders and agronomists from West and Central Africa by WECAMAN in collaboration with the Group Training and Biometrics Units of IITA from 11-21 June, 1996 at the Rural Management Training Institute (ARMTI) in Ilorin, Nigeria. The course was designed to upgrade the skills of national scientists in the analysis

and interpretation of complex statistical data, selection of appropriate statistical methods for data analysis and in the use of the GENSTAT package.

The course emphasised the following areas:

- Computer and data management applications
- Data manipulation with GENSTAT
- GENSTAT procedures for analysis of various designs
- GxE interaction analysis
- Regression models
- Classification analysis with GENSTAT
- AMMI analysis using the mat model software

The course was attended by 17 participants 14 of whom came from network member countries and were sponsored by WECAMAN. Two of the remaining participants were sponsored by the Sorghum Network and the third by the IITA liaison office in Ghana.

(ii) ***Monitoring tour to Ghana and Burkina Faso***

A monitoring tour involving eight participants from network member countries was organized by WECAMAN to Ghana and Burkina Faso from 15-27 September 1996. The objectives of the tour were to:

- discuss maize production constraints of the two countries
- discuss research being conducted and methodologies used to solve the problems relating to maize production: how research, extension and production are organized in the countries and the linkages that are in place between research and extension to facilitate technology development and transfer
- provide a forum for interaction among national scientists on issues relating to maize research, extension and production
- monitor collaborative research projects funded by WECAMAN in the two countries

The lessons learnt from the monitoring tour by the participants were the following:

A. *Crops Research Institute, Fumesua, Kumasi, Ghana.*

1. Although maize had been harvested before the visit, it was quite evident that the maize improvement scientists at CRI were very committed to their research and were working very closely with NGO's like SG 2000 and other government agencies to

ensure the transfer of technology to farmers.

2. A tremendous amount of facilities are in place at the Crops Research Institute for the development of QPM and dissemination of information to farmers. Using these facilities the QPM variety Obatanpa had been promoted and widely adopted in Ghana.

3. CRI has a training and communication unit which is equipped with modern equipment such as TV, audio-visuals and highly trained staff. The unit has developed for MOFA video tapes and extension materials which are used for promotion of technology transfer.

4. Seed production is well organized in Ghana with CRI producing adequate quantities of breeder seed of released varieties while the GLDB produces foundation seed of maize as well as planting materials such as cassava, yam and forest tree seed. GLDB also provides custom services to seed growers (drying and processing of seed as well as storage) and manages the national seed storage stocks. The foundation seed produced by GLDB is sold to private commercial and registered seed growers who produce the certified seed. Effective quality control is ensured through laboratories set up for seed health, moisture and germination tests maintained by the Seed Inspection and Certification Units.

5. Three QPM hybrids and one extra-early maturing variety, NAES extra-early developed by the scientists and WECAMAN have been inspected by the varietal release committee and was expected to be released soon.

6. Distribution of seed through sales outlets in Kumasi was impressive. Several seed sale outlets were visited in Kumasi market. The seeds were well packaged and labelled with the seal of the seed inspectorate unit.

B. *Savanna Agricultural Research Institute (SARI) Nyankpala*

1. There is a great potential for maize production in Northern Ghana if the constraint of poor soil fertility and *Striga* could be addressed. By 1992, maize was not very important in the Manga area (Sudan Savanna) of the Northern Ghana and the predominant cropping system was based on sorghum and millet. This has now changed to maize with the result that there is a significant increase in the area planted to maize. The area under maize is currently increasing at the expense of sorghum and millet. Farmers in this Sudan Savanna zone have realised the need to apply some manure to their fields. The available improved maize varieties include Safita-2, Dorke-SR, Abeleehi, Obatanpa and NAES extra-early, a variety identified by the Ghanaian scientists through the RUVT-extra early. The adoption rate of these varieties is very high with farmers themselves going to the researchers for seed of these varieties.

2. *Striga* damage is very serious in the Manga area due to the poor soil fertility. Besides the need for early maturing varieties and the problem of poor soil fertility, the farmers considered *Striga* as the major constraint to increased maize production and productivity. Rotation with legumes and hand pulling are used to control *Striga*.

3. Preliminary results of a study of maize marketing in Northern Ghana revealed that the two main actors in the maize trade are middlemen and farmers. Purchases were made directly from farmers' homes and along the road to the markets or from the farms. The study was funded by WECAMAN.

4. The RUVT-early and RUVT-extra early and other collaborative trials such as the *Striga* trials at all locations were well established and managed. However, the *Striga* emergence in all the *Striga* trials was very low.

5. Agronomic trials like the WECAMAN funded cereal/legume rotation, alley cropping and the on-farm trials were not well managed and the plots were very weedy.

6. On-farm trials at Tamale unlike those at Manga were very poorly conducted by SARI Scientists and participants noted that this was partly the result of lack of commitment on the part of the scientists.

7. A community seed production scheme funded by WECAMAN and involving 4 ha of Obatanpa was well established although the farms were weedy. Ten farmers were involved in the community seed production and there were plans to train these and other farmers in the techniques of seed production in 1997.

8. Maize utilisation in Ghana is well addressed through the activities of Women in Agricultural Development (WIAD) which also evaluates the consumer preference of varieties under consideration for release. About 8 different local dishes prepared from maize were displayed.

9. Average yield of maize in farmers' fields is very low because most farmers use very little fertiliser because of the high cost.

10. Farmers in rural areas of northern Ghana plant seed of old varieties selected from their own farms. Where improved varieties are grown by farmers, the seed is not usually renewed after 2 to 3 years. This was observed to be mainly due to the lack of education and the very few seed sale outlets in the rural areas.

C. *Burkina Faso*

1. WECAMAN RUVT early and other collaborative trials were well established and managed.

2. The research team at Farako-Ba station is doing a good job in converting maize varieties for resistance to the streak virus. The level of streak resistance in the Maka variety was observed to be very low.

3. WECAMAN RUVT trials and the resident research program of the Network Coordinator at Kamboise were well established and managed. The outstanding entries in the RUVT-early were Dorke SR, EV DT 94 C2 and Across 95 TZE comp 5W while 95 TZEE W-SR, NAES-EE-W and KEJ were the most promising entries in the RUVT-extra early.

4. The use of *Parkia biglobosa* powder for *Striga* control was found to be very effective when applied at 750 g/m2 and 500 g/m2 at planting. There was no emergence of *Striga* in the plots that received these treatments. The trial was well laid out and managed.

5. There was no clear indication of organized seed distribution system in Burkina Faso.

6. The on-farm trials involving the use of Burkina phosphate and composted organic manure and coordinated by CRPA du Centre was well managed but there was no involvement of an agricultural economist whose data are important for cost-benefit analysis to ensure the potential adoption of the technology.

7. Maize utilisation in Burkina Faso is well addressed through private women associations. Over 10 dishes from maize are currently popular in different households in Burkina Faso. Three out of the 10 maize dishes were displayed to the participants.

8. Seed production in Burkina Faso is very well organized and four models were observed. These were:

Model 1: WECAMAN works in collaboration with INERA in the production of breeder and foundation seed. The researchers provide the foundation seed and other inputs to selected farmers who produce the certified seed. The farmers get the seed and inputs via CRPA (extension service). At harvest, the farmers reimburse the input cost to CRPA.

Model 2: Initially, surveys are conducted by CRPA to identify the resource capabilities of farmers to be contract seed growers. Farmers are provided with foundation seed for them to produce certified seed. These are sold directly to CRPA which then deducts input costs.

Model 3: The farmers receive the foundation seed once from the researchers, but farmers are responsible for the purchase and use of inputs in the production of certified seed. The only assistance provided to farmers is technical.

Model 4: NGO's organise farmers for production of certified seed. They provide improved seed and other inputs to farmers. At harvest, 50% of the initial funds are deducted and provided to extension (CPRA) for the encouragement of seed production by other farmers.

The monitoring tour provided a means for strong interaction among the national scientists and also reinforced the goals of networking.

(iii) ***Technician training course***

Lack of sufficient, well trained and skilled research workers constitute one of the major constraints to maize research and development in West and Central Africa. Quite often, technicians in our countries are called upon to play the role of researcher's by taking over entire maize programs of their respective countries during the absence of the researchers. It is in an effort to mitigate the problem of lack of skilled research personnel that the maize network has been organising the maize technician course for member countries since 1988.

The 1996 course which started on 1 July at Ferkessedougou is expected to end on 22 November,.1996 and has eight participants from network member countries and a participant from Kenya as follows:

Yameogo Paul	Burkina Faso	Etchi Shadrack-Ayuk	Cameroon
Titus Ochibe	Nigeria	Mawunya Michael	Ghana
Abdoulaye Cisse	Mali	Allah Amoin Virginie	Côte d'Ivoire
Lare Tchenliak	Togo	Agonse Guy	Benin

The Kenyan participant is sponsored by the CIMMYT Côte d'Ivoire maize program while the remaining participants are sponsored by WECAMAN.

The course is practical-oriented, lasting the whole planting season with resource persons drawn from Côte-d'Ivoire and Togo , IITA, CIMMYT and WARDA involved in the course. The course is emphasising field plot techniques, trial management, variety maintenance, seed multiplication, statistical analysis, data interpretation and report writing. In addition, each trainee has been assigned a project to manage from planting through harvesting. The practical training is complemented with lectures covering all aspects of maize breeding, agronomy, seed production, weed and pest control, farm management, experimental design and the use of computers.

2.7 Information exchange activities carried out by network member countries in 1995/96

The publications listed below were made available to the NARS collaborators in an effort to ensure regional spill-over of promising technologies in the pipeline during 1995/96:

1. Brochure on WECAMAN
2. 1994/95 Annual Report of WECAMAN
3. Report of the fourth meeting of WECAMAN Steering Committee
4. Report of the fifth meeting of WECAMAN Steering Committee
5. Compilation of the results of 1995 Regional Variety Trials
6. Report of the third meeting of the ad hoc Research Committee of WECAMAN
7. Proceedings of the 1995 Regional Maize Workshop

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