West and Central Africa Maize Research Network

(WECAMAN)

Annual Report
1996/97

Funded by

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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, 1996 to September 30, 1997.

During the review period, the activities of the maize network approved by the Steering Committee during its meeting in IITA-Cotonou, Benin, 24-25 April, 1996 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
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
ITRA	Institut Togolais de Recherches Agricoles
NARS	National Agricultural Research Systems
OIC	Opportunities Industrialization Center
OAU	Organization of African Unity
RRPMC	Regional Research Project 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 Collaborative Research Network

Acknowledgements

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The network is grateful to the Director of INERA, Burkina Faso for offering land and research facilities at Kamboinsé 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 and OAU/STRC SAFGRAD co-operated fully with the network and are gratefully acknowledged.

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Bouake, October, 1997

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.

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EXECUTIVE SUMMARY

The West and Central Africa Maize Collaborative Research Network (WECAMAN) made significant progress towards the attainment of its strategic objectives during the period 1 October, 1996 - 30 September, 1997. A total of $22500 was released by WECAMAN in support of community seed production schemes in Burkina Faso, Benin, Cameroon, Mali, Togo, Cote d'Ivoire and Ghana. Through this project, several quantities of seed of released maize varieties were produced. Also, several farmers were trained in the techniques of seed production.

In order to promote the transfer of improved technologies in network member countries, WECAMAN funded on-farm tests and demonstrations in Benin, Mali, Togo, Cameroon, Cote d'Ivoire and Nigeria in 1996. Through this project, several maize varieties have been released to farmers for production while some of them have been adopted by member countries for national adaptive trials. Also, following the workshop on extension material development, WECAMAN released funds to Burkina Faso, Benin, Togo and Cameroon for the publication of extension materials.

The national maize programs of Cameroon, Burkina Faso, Ghana and Togo as well as the Network Coordinator nominated early and extra-early varieties developed in their research programs for the Regional Uniform Variety Trials (RUVT). Some of these varieties showed outstanding performance in the RUVT and have been identified for release in some network member countries.

Two main activities were carried out to enhance the capacity within the network to carry out collaborative research program with minimum outside support. These included a regional maize workshop and an impact assessment workshop. The tenth anniversary WECAMAN workshop was held at IITA, Cotonou, Benin, 21-25 April, 1997. The workshop was attended by 60 scientists from the sub-region. Participants presented and discussed 37 scientific papers, 12 lead papers and eight country reports. In an effort to improve the impact assessment capability and capacity within network member countries, WECAMAN sponsored a scientist each from Mali and Burkina Faso to an impact assessment workshop in Burkina Faso in July, 1997. Also, a scientist each from Ghana and Nigeria were sponsored to a similar impact assessement workshop in Ghana in August, 1997.

In an effort to demonstrate that there are good returns to investments in maize research in network member countries and thereby influence agricultural policy, impact assessment of research on maize production and productivity were funded by WECAMAN in Cameroon and Togo in 1996.

1. INTRODUCTION

The West and Central Africa Collaborative Maize Research Network (WECAMAN) evolved from the second phase of the Semi-Arid Food Grains Research and Development (SAFGRAD) project which extended from March, 1987 to March, 1993. The present funding phase of WECAMAN which started on October 1, 1993 is scheduled to end on 30 September, 1998.

The maize network with backstopping from IITA has during the past four years established an effective collaborative research system with active participation of NARS of 8 countries in West and Central Africa. The maize network has promoted interest in maize research and the linkages developed within and among NARS scientists have greatly increased the morale of individual scientists. The enhanced interaction (through monitoring tours, workshops, special purpose seminars) coupled with the training activities organized by WECAMAN and the technical backstopping provided by IITA have increased the efficiency and effectiveness of research within individual national programs through sharper focusing on major constraints and better utilization of resources. The activities have also greatly encouraged professionalism among NARS scientists.

The network has allowed research responsibilities to be assigned on competitive basis among NARS scientists, thus minimizing 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 and exchanged among network member countries. As a result, each NARS has been able to identify suitable technologies for different environments. Several maize cultivars have been adopted by member countries for national adaptive trials while some of them have been released to farmers for production.

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 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, 1996 to 30 September, 1997.

2. ACHIEVEMENTS OF THE MAIZE NETWORK IN 1996/1997

The activities of the maize network may be divided into four categories as follows:

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

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

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

C Activities concerning impact of research on maize production and productivity (refer to section 2.8).

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

2.1 PROMOTION OF TECHNOLOGY TRANSFER

Technology transfer constitutes a major weakness within the National Agricultural and Extension Research Systems (NARES). WECAMAN has adopted three strategies for promoting technology transfer in member countries. 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 organized activities aimed at strengthening researcher-extensionist-farmer linkages in member countries in order to foster the adoption of improved technologies.

The activities organized by the network during the period under review in an effort to strengthen researcher-extensionist-farmer linkages within the respective member countries included:

i) Annual maize workshops within member countries

In order to strengthen researcher-extensionist-farmer linkages in network member countries the

Steering Committee decided in 1993 that maize workshops should be regular activities in the respective member countries. WECAMAN has to encourage and assist member countries where such workshops are not already being organized.

Annual maize workshops and planning sessions were held in network member countries during the period under review as follows:

Cameroon: Planning meetings on research activities were conducted in Northern Cameroon for all the major crops including maize.

Ghana: A workshop was organized for all crops including maize. Planning sessions on maize were also held throughout Ghana.

Mali: Two annual meetings on maize research activities were organized in local languages.

Togo: A national workshop involving all major crops in the country was organized and constraints to maize production and productivity were discussed.

Burkina Faso: A national workshop involving all major crops, including maize was held.

Nigeria: Maize planning sessions were held and themes defined. All researchers were brought together in the context of the nationally coordinated research on maize.

Benin: A national maize workshop was held for the first time in Benin with the financial support of WECAMAN.

In all cases, the workshops involved researchers, extensionists, policy makers and farmers. The objectives were to review research findings, grower recommendations and agricultural policies.

The planning sessions were aimed at establishing research-extension-farmer linkages so that the three bodies could influence the research agenda of the respective network member countries.

ii) Publication of extension manuals on maize

A course on the development of extension manuals and farmer handbooks was organized for two participants each from 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 financial support of WECAMAN. Funds have been released to Togo, Burkina Faso, Cameroon and Benin in support of the publication of the extension materials submitted to WECAMAN for editing.

b) On-farm tests and demonstrations

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

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

Table I On-farm tests conducted by WECAMAN member countries in 1996

Countries		Varieties tested on-farm	NE of farmers
Côte d'Ivoire	Early	DMR-ESRY TZE Comp 4	12
	Extra-early	CSP SR BC_5 TZE SR-W x Gua 314	3
Benin	Extra-early	TZEEW-SR	24
	Early	Kamb 88 Pool 16 DT	25
Mali	Intermediate	Sotubaka EV 8422 SR	30
Togo	Extra-early	TZESR-W x Gua 314	8
	Early	Amen, AB II	8
Nigeria	Early	AB II, TZE Comp 3	8
Cameroon	Pigeon pea		300

BENIN

An extra-early variety, TZEE-W-SR and an early drought tolerant variety, Kamb 88 Pool 16 DT were separately compared with the farmers' variety in on-farm trials in the Sudan savanna and Sudano-Sahel in Benin. Twenty-four and 25 farmers participated in the tests involving TZEE-W SR and Kamb 88 Pool 16 DT, respectively.

No significant differences were detected between the improved maize varieties and the farmers' varieties in the Sudano-Sahel region. However, Kamb 88 Pool 16 DT outyielded the farmers' variety

in the Sudan savanna zone (Table 2).

Table 2 Grain yield of early varieties evaluated at 16 sites on-farm in the Sudan savanna zone of Benin

Variety	Grain yield (kg/ha)
Kamb 88 Pool 16 DT	1892
Farmer's variety	1216
CV (%)	28.71
LSD (5%)	0.34

Farmers showed preference for TZEE-W SR and Kamb 88 Pool 16 DT because of the earliness and drought tolerance, respectively.

Based on the results of the on-farm trials the two varieties have been released for production in Benin.

CÔTE D'IVOIRE

Three trials involving 3 extra-early varieties (CSP SR BC_5, Local variety, and TZESR-W x Gua 314) were conducted at Nielle while twelve trials involving 3 early varieties (TZE Comp 4, DMR-E-SR-Y and Local variety) were conducted at Nielle and Ferkéssédougou.

Even though no significant differences were detected between the improved maize varieties and the local check, the farmers preferred the improved early and extra-earlies tested because of the drought tolerance and earliness. Based on the results the varieties have been proposed for release as follows:

Nielle: CSP SR BC_5, TZESR-W x Gua 314
DMR-ESRY, TZE Comp 4

Ferke: TZE Comp 4, DMR-ESRY

TOGO

Three improved maize varieties, Amen, AB II (both early maturing) TZEE-W SR (extra-early) and the local variety (check) were evaluated on-farm at two sectors in the Kara region of Togo. Eight farmers trained in on-farm testing were used as the collaborators. The farmers involved in the trials were provided with fertilizer and seed of the improved varieties and were supervised by the extension agents in the zones to apply the treatments. Three field days which allowed several other

farmers to visit the trials and to see the performance of the new varieties were organized in each zone (Table 3). Also in attendance at the field days were the Director of Agricultural Research of Togo, extensionists and representatives of the President of Togo in Assoli and Doufelgou zones of the Kara Region.

Tables 3 Participants of the field days organized at three zones in Togo in 1997

Zone	Females	Males	Total
Koumande	20	55	75
Bafilo centre	65	135	200
Baga East	15	45	60

The results of the cost benefit analysis of the on-farm trials showed that using the package of recommended technology, maize production in the Kara region of Togo is economic (Tables 4 and 5). Even though the local variety, Boucam gave very interesting returns when planted using the recommended improved production practices such as fertilizer and the population densities, the farmers did not like it due to the undesirable yellow grain color.

Table 4 Cost benefit analysis of the production of the recommended improved maize varieties in the Assoli sector of the Kara Region, Togo

	Amen	AB II	TZESR-W x Gua 314	Local varieties	
				Ikenne	Boucam
Mean grain yield (kg/ha)	1625	1927	1477	1867	1638
Total revenue	227500	269780	206780	261350	229320
Cost of production	151450	151450	151450	151450	151450
Net revenue	76050	118330	55330	109930	77870

Table 5 Cost benefit analysis of the production of the recommended improved maize varieties in the Doufelgou sector of the Kara Region of Togo

	Amen	AB II	TZESR-W x Gua 314	Local Checks	
				Ikenne	Pozarica
Mean grain yield (kg/ha)	1580	2073	1655	1863	1389
Total revenue	221200	290220	231700	260820	194460
Cost of production	151450	151450	151450	151450	151450
Net revenue	69750	138770	80250	109370	43010

The results also revealed that for the production of Amen (early) and TZESR-W x Gua 314 (extra-

early) to be economic it would be necessary to have two crops of maize per year or to adopt relay or intercropping involving maize and legumes such as cowpea and groundnuts. In any case, because of the earliness and the inherent ability of the two varieties to escape drought the demand for the seed of the three improved varieties AB II, Amen and TZESR-W is quite high in the Kara region and serious efforts are being made by the researchers and extensionists involved in the project to satisfy the demand through the community seed production project funded by WECAMAN in Togo.

MALI

Two improved, intermediate maturing varieties, Sotubaka and EV 8422 SR were compared with local varieties (checks) on 30 farmers fields in Mali.

EV 8422 SR and Sotubaka confirmed their high yield potential and good adaptation in all the test locations (Table 6).

Table 6 Grain yield (kg/ha) of two improved maize varieties evaluated on-farm at 30 sites in Mali in 1996

Variety	Grain yield (kg/ha)
EV 8422 SR	3770
Local	3210
Sotubaka	4339

NIGERIA

Researcher managed on-farm trials involving twelve extra-early varieties were conducted in collaboration with farmer groups at Kafinsoli and Ladanawa in the Sudan savanna zone of Nigeria. The purpose was to promote the adoption of the extra-early varieties and to identify the appropriate varieties for the various locations.

Based on the results of the on-farm tests the extra-early varieties, 95 TZEE-W_1, 95 TZEE-Y_1 and TZEE-W SR BC_5 were selected at Ladanawa on the basis of high yield and color. However, 95 TZEE-Y_1, 95 TZEE-W_1 and TZESR-W x Gua 314 were selected at Kafinsoli not only because of the high yield potential but also the superior plant height and total biomass production which are desirable for livestock production.

On-farm trials involving eight farmers were conducted at Kaya in the Sudan savanna zone to evaluate the performance of the two early maize varieties, TZE Comp 3 and AB II. The two varieties had been identified as promising in the RUVT-early after three years of on-station evaluation in Northern Nigeria. Two commercial late maturing varieties, PANAR 6519 or OBA Super I were used as the checks.

The results of the on-farm trials showed that the two early maturing varieties reached physiological maturity 25-36 days earlier than the commercial hybrids (Table 7). However, the grain yield of the hybrids were superior to that of the early varieties by 13-16%. Nevertheless, the farmers showed preference for the early varieties on account of the earliness and have requested for seed.

Table 7 Performance of early maturing maize varieties evaluated on-farm at Kaya, Nigeria in 1996

Variety	Days to physiological maturity	Grain yield (kg/ha)
TZE Comp 3	89	3410
AB II	89	3340
Pannar 6519 (check)	117	3860
Oba Super (check)	123	3970
LSD (.05)	14	0.35
CV (%)	89	18

A field day was held on 21 September, 1996 at Kaya to exhibit as well as document farmers opinions on the potential of the two early maturing varieties evaluated on-farm at Kaya. A total of 428 participants attended the field day. The participants included representatives of all the major seed companies in Nigeria, research institutes, commercial seed distribution companies, farmer groups/associations, traditional rulers, Local Government Councils and individual farmers. The eight fields of the collaborating farmers were visited.

CAMEROON

Results of studies in the northern Guinea savanna of Cameroon involving the use of legumes such as *Crotolaria spp., Calopogonium, Mucuna, Cassia, Stylosanthes, Canavalia ensiformis*, cowpea, groundnut, soybean and pigeon pea in rotation or intercropping with maize to improve soil fertility, control erosion and *Striga* have identified pigeon pea and *Crotolaria* as the most promising. Given the reluctance of farmers to use in rotation or intercropping, crops like crotoloria which do not have immediate economic returns and the low cost of pigeon pea management, activities aimed at promoting the integration of pigeon pea into the farming system of the northern Guinea savanna of Cameroon was initiated in 1996 with funding from WECAMAN.

In order to promote the consumption and soil fertility improvement through the growth of pigeon pea on farmers' fields, the seed was distributed to 300 farmers and 30 demonstration plots and cooking sessions were organized in collaboration with the delegations of the Ministry of Agriculture

and some women of the Social Welfare Department. The high commission for refugees in Cameroon also participated in the activities and purchased 100 kg of seed for the refugees.

2.2 *DEVELOPMENT OF SUSTAINABLE SEED PRODUCTION AND DISTRIBUTION SYSTEM IN WEST AND CENTRAL AFRICA*

In spite of the substantial breeding effort and the large number of open-pollinated varieties (OPV's) released in West and Central Africa since the late 1990s, their impact has not been as high as anticipated. A major reason for the lack of the desired impact is the lack of availability of good quality seed of improved OPV's.

Growing skepticism about the role of the seed industry has made national governments and donor agencies less willing to support state seed enterprises. Consequently, many of the seed enterprises have been closed down in several countries including Ghana and Cameroon. As a result, adoption of improved OPV's is often a one-time event, and farmers do not benefit from the yield gains offered by the release of new and higher yielding cultivars.

Sustainable OPV seed production and distribution in West and Central Africa could possibly be fostered through the strengthening of local seed organizations. Farmer cooperatives, NGOs and individual farmer/seed producers are increasingly becoming important in the sub region where they often concentrate on producing and/or distributing improved OPVs to farmers who may benefit most from this kind of germplasm. It is therefore important that the network support these seed producers in the promotion, diffusion and utilization of suitable seed production technologies.

Stimulating the network member countries to develop efficient on-farm level seed production schemes has therefore become an important component of the network technology transfer project since 1994.

The support of the network has been, through continuous supply of improved germplasm adapted to local conditions, technical assistance with seed production, training, the provision of credit in the form of inputs for seed production, and promotion of improved OPVs to encourage adoption.

The network is presently funding community level seed production schemes in Burkina Faso, Benin, Cameroon, Mali, Togo, Côte d'Ivoire and Ghana. A total amount of $22500 was allocated by WECAMAN in support of the community seed production scheme in 1996.

The goal of WECAMAN in the intervention of the seed industry in West and Central Africa is to assist farmers and seed producers to develop sustainable seed production systems capable of providing a regular supply of seed of superior varieties of high quality to the farming communities.

The specific objectives of the community seed production project are to:

- train farmers in the techniques of maize seed production,

- strengthen the capacity and capability of seed producers to produce good quality seed,
- encourage NARS scientists to work with selected farmers and non-governmental organizations (NGOs) in the development of on-farm level seed production schemes,
- assist NARS scientists to produce breeder seed of released varieties in adequate quantities at the research stations.

The quantities of seed produced by the network countries in the community seed production scheme are presented in Tables 8-18 while the number of farmers trained in the techniques of seed production is shown in Table 19.

Table 8 Quantity of breeder seed produced in network member countries in 1996

Countries	Names of varieties	Quantity of seed produced (kg/ha)
Burkina Faso	DMR ESR-W	3
	Pool 16 DT	7
	CSP SR	2
	TZEE-SR-W	1
	TZEE-Y-SR	9
Cameroon	CMS 8501	21
	CMS 8704	32
	CMS 9015	9
	CMS 8806	6
	TZEE-W SR	3
	CSP x TZEE-Y	3
Benin	DMR ESR-W	155
	Kamb 88 Pool 16 DT	135
	TZEE-W-SR	75
Togo*	Ikenne 8149 SR	N/a
	AB II	N/a
	Amen	N/a
	TZESR-W	N/a
Cote d'Ivoire*	CSP SR BC_5	N/a
	TZEE-SR-W	N/a
	DMR ESR-Y	N/a

* Adequate quantities of breeder seed of the varieties listed were produced but quantities not available

Table 9 Quantity of foundation seed produced in Togo in 1996

Location	Variety	Area (ha)	Quantity of seed (kg/ha)	Maturity group
Davie	Ikenne 8149 SR	0.25	400	Intermediate
Davie	TZESR-W x Gua 314	0.25	400	Extra-early
Adeta	Amen	0.25	570	Early
Adeta	AB II	0.25	200	Early
TOTAL		1.00	1570	

Table 10 Quantity of foundation seed produced in Cameroon in 1996

Varieties	Quantity of seed produced (kg)
CMS 8501	1600
CMS 8704	2300
CMS 9015	2100
TZEE-W-SR	1100
CSP x TZEE	900
CMS 8806	300
Total	8300

Table 11 Quantity of foundation seed produced in Benin in 1996

Variety	Quantity of seed produced (kg)
DMR ESR-W	1165
Kamb 88 Pool 16 DT	940
TZEE-W SR	940
Total	3045

Table 12 Quantity of foundation seed produced in Cote d'Ivoire in 1996

Variety	Area (m^2)	Quantity of seed produced (kg)
CSP SR BC_5	3127	376
TZEE SR-W	3468	518
DMR ESR-W	1175	202
TZE Comp 4	1568	263
Total	9338	1359

Table 13 Quantity of foundation seed produced in Burkina Faso in 1996

Variety	Quantity of seed produced (kg)
Maka SR	4000
KEJ	200
KEB	180
KPJ	720
KPB	3920
SR 22	6000
FBC_6	6000
Total	21020

Table 14 Quantity of seed produced on-farm in Cameroon in 1996 under the community seed production scheme

Location	Varieties	Area (ha)	Quantity of seed produced (kg)	Quantity of seed collected (kg)
Mara	CMS 9015	0.5	1100	250
	DMR ESR-Y	0.5	700	127
Djalingo	CMS 9015	0.5	1400	350
	DMR ESR-Y	0.5	750	190
Touboro	CMS 8501	1.0	1900	400
Total		3.0	5850	1317

Table 15 **Quantity of seed produced on-farm in 1996 in Togo under the community seed production scheme**

Name of farmer group	Varieties	Area (ha)	Quantity of seed (kg)
Asséré Souang	Ikenne 8149 SR	1.0	4500
	AB II	0.5	1000
Bidjanbé	Ikenne 8149 SR	1.0	500
	TZESR-W x Gua 314	0.5	-
Atsangbadé	Amen	0.25	200
Gnabana	Amen	1.0	-
Batana	Amen	0.25	200
Kpatcha	Amen	0.5	300
	Pozarica	0.5	300
Total		4.0	7000

Table 16 **Quantity of seed produced on-farm in 1996 in Benin under the community seed production scheme**

Varieties	Quantity of seed (kg)	Number of farmer groups	NE of farmers/ association
DMR ESR-W	71460	2	30
Kamb 88 Pool 16 DT	30350	2	25
TZEE-W-SR	9150	2	18
Total	110960	6	73

Table 17 **Quantity of seed produced on-farm in Ghana in 1996 under the community seed production scheme**

Varieties	Quantity of seed (kg)	Number of farmers
Dorke SR	2500	5
Obatanpa	2500	5
Total	5000	10

Table 18 **Quantity of seed produced on-farm in Burkina Faso in 1996 under the community seed production scheme**

Varieties	Kamboinse (kg)	Tikare (kg)	CRPA Comoe (kg)	CRPA Centre (kg)	CRPA H.B. (kg)	CRPA B.M. (kg)
KPB	320	-	-	400	-	-
KPB	240	-	6000	-	18000	15000
Maka SR	-	40000	-		-	-
KEJ	200	-	-	-	-	-
KEB	180	-		-	-	-
FBC6	-	-	6000	-	-	-
SR 22	-	-	20000	-	40000	
TOTAL	940	40000	32000	400	58000	15000

Table 19 **Number of farmers and seed producers trained in seed production in WECAMAN member countries in 1996**

Country	N° of villages/seed production associations	N° of farmers /seed producers
Cameroon	-	4
Burkina Faso	5	135
Benin	6	73
Mali	5	100
Togo	5	92

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 major constraints to increased maize production and productivity in the semi-arid zone of West and Central Africa include drought and *Striga hermonthica.* Yield losses due to drought in sub-Saharan Africa are estimated to be 15% annually. However, localized losses may be much higher in marginal environments where annual rainfall falls below 500 mm, or where soils are sandy or shallow. *Striga* hermonthica can cause yield losses ranging from 15-20% with the losses in certain cases as high as 50-90%. This has resulted in several farmers abandoning their farms. Tolerance /resistance to soil moisture stress and *Striga hermonthica* are therefore important traits for increased production and productivity in the semi-arid zone of West and Central Africa.

Cameroon, Ghana, Burkina Faso and Côte d'Ivoire have been assigned on a competitive basis research responsibility for the development of varieties with resistance/tolerance to drought and *Striga hermonthica* for the network member countries. These lead centers and the network coordinator have screened and developed promising early and extra-early maturing drought tolerant and *Striga* resistant varieties and populations. Through this program, Cameroon, Togo, Ghana, Burkina Faso and the network coordinator contributed entries for the 1996 extra-early and early Regional Uniform Variety Trials (RUVT) (Tables 20a and 20b).

Table 20a Contribution of entries to the 1996 RUVT-Extra early

Entry name	Proposed by
KEJ	Burkina Faso
KEB	Burkina Faso
TZEE-Y-SR BC_5	IITA / WECAMAN
TZEESR-W x Gua 314	"
CSP SR BC_5	"
TZEE-W SR BC_5	"
TZEF-Y SR	"
CSP x Local Raytiri	"
95 TZEE-W_1	"
95 TZEE-Y_1	"
CSP-SR x TZEE-Y	Cameroon
Check	Collaborator

Table 20b Contribution of entries to the 1996 RUVT-early

Entry name	Proposed by
Kamb 88 Pool 16 DT (Re)	WECAMAN/Burkina Faso
Farakobâ Pool 16 DT (HD)	WECAMAN / Burkina Faso
AB II	Togo
Syn E_2	Cameroon
NAES Pool 16 DT	Ghana
TZE Comp 4 DMR BC_1	IITA
ACR 92 TZE Comp 5	IITA
TZE Comp 3	IITA
TZE Comp 4	IITA
AK 9331 DMR SR BC_3	IITA
Dorke SR	Ghana
KPB	Burkina Faso
KPJ	Burkina Faso
EV DT 94 C_2	WECAMAN / IITA
DT-E-Y-SR BC_3	WECAMAN / IITA
Check	Collaborator

The results of the RUVT-early across 16 locations in West and Central Africa showed TZE Comp 4 DMR BC_2 as the highest yielding entry while DT-E-Y-SR recorded the lowest grain yield (Table 21). However, there was no significant differences between the yield of TZE Comp 4 DMR BC_2 and the top five entries including the reference check, Kamboinse 88 Pool 16 DT. Syn E_2, Dorke SR, ACR 92 TZE Comp 5-W and AB II were the latest maturing varieties in the trials while AB II and Dorke SR were the tallest.

Table 21 1996 RUVT-Early trials at 16 locations in 8 countries: across location means for grain yield and other agronomic characters

Pedigree	Grain Yield (kg/ha)	DYS Silk No.	PL HT (cm)	E HT (cm)
TZE Comp 4 DMR BC_2	3978	52	148	68
AK 9331 - DMRSR	3943	52	145	67
TZE Comp 4 C_2	3854	54	145	66
TZE Comp 3 C_1	3800	53	144	68
ACR 92 TZE Comp 5-W	3761	55	148	73
Kamboinse 88 pool 16 DT	3750	53	144	69
Syn E_2	3719	58	141	72
Check	3690	54	150	71
AB II	3623	56	164	88
Dorke-SR	3606	56	159	78
EV DT 94 C_2	3537	53	143	69
Farakoba 90 Pool 16	3393	52	140	66
NAES Pool 16 DT	3371	51	137	64
KPJ	3369	51	140	61
KPB	3332	52	137	63
DT-E-Y SR	3157	53	140	65
Grand Mean	3618	53	146	69
LSD	234	1	4	4
SED	142	0	3	2
CV	20	4	9	17

YIELD: t/ha at 15 % moisture
DYS.SILK: Days to silking
PL.HT: Plant height
E.HT: Ear height

The combined analysis of grain yield of the extra-early varieties at 21 locations is presented in Table 22. Grain yield ranged from 3676 kg/ha for 95 TZEE-W_1, to 2560 kg/ha for TZEE-Y-SR BC_5. It is interesting to note that the two new entries from the resident research program of the Network Coordinator, 95 TZEE-W_1, and 95 TZEE-Y_1 and CSP-SR x TZEE-W SR from the Cameroonian maize program were comparable in grain yield to the best available extra-early variety, TZESR-W x Gua 314 and significantly outyielded the reference entry, TZEE-W-SR BC_5. This indicates that new and higher yielding extra-early varieties are continuously being made available to the network collaborators.

Based on the results, 95 TZEE-W_1 and 95 TZEE-Y_1 have been identified for on-farm tests in Nigeria while TZEF-SR is under consideration for release in Nigeria and Mali.

In addition to the varieties nominated for the RUVT, significant progress was made by the Network

Coordinator in the program to develop *Striga* and drought resistant source populations and varieties for the network member countries. The development of white and yellow drought tolerant and *Striga* resistant early populations, TZEW-Pop STR (white), TZE-Y-Pop STR (yellow) and the extra-early populations, TZEE-W Pop STR (White) and TZEE-Y Pop STR (Yellow) was completed after five cycles of compositing and screening under artificial *Striga hermonthica* infestation and induced drought stress source. The populations are being made available to the national maize programs to serve as source of *Striga* and drought tolerant varieties. Also, a drought and *Striga* tolerant variety EV DT 97 STR has been developed and would be made available for testing in the RUVT in 1998.

Table 22 1996 RUVT-Extra early trials at 21 locations in 8 countries: across location means for grain yield and other agronomic characters

Pedigree	Grain Yield (kg/ha)	Dys Silk (cm)	PL HT (cm)	EHT
95 TZEE-W_1	3676	45	138	62
Check	3635	43	136	63
TZESR-W x Gua 314 BC	3467	44	136	58
95 TZEE-Y1	3438	44	141	62
CSP-SR x TZEE-W SR	3347	43	137	61
KEB	3271	42	133	56
KEJ	3155	41	128	51
TZEE-W-SR BC_5	3136	42	134	59
CSP-SR BC_5	2990	42	125	50
TZEF-Y SR BC_3	2913	43	136	61
CSP x Local Raytiri	2640	43	130	55
TZEEE-Y-SR BC_5	2560	43	132	55
Grand Mean	3186	43	134	58
LSD	215	1	4	3
SED	131	0	3	2
CV	23	5	12	20

YIELD: t/ha at 15 % moisture
DYS. SILK: Days to silking
PL.HT: Plant height
E.HT: Ear height

2.4 DEVELOPMENT OF SUITABLE AGRONOMIC PRACTICES TO ENHANCE MAIZE PRODUCTIVITY AND PRODUCTION

The savanna of West and Central Africa has high potential for maize production. However, grain yield is low due to *Striga* damage and soils which are inherently poor, fragile and rapidly degrade

under intensive cropping. There is therefore a need for technologies which will ensure sustained and high crop yields to feed the rapidly increasing population.

The importance of legumes in soil fertility maintenance, weed suppression and crop yield sustainability has been amply demonstrated by research. 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 adapted to intercropping and relay cropping need to be identified.

The progress made by the lead centers for this project, Burkina Faso, Nigeria, Togo, Benin, Ghana, Mali and Cameroon in developing suitable agronomic practices that could enhance maize productivity and production in the respective countries in 1996 was as follows:

C Preliminary results of studies to quantify the beneficial effects of pigeon pea grown in rotation with maize in the northern Guinea savanna of Cameroon revealed that the residual beneficial contribution of pigeon pea as a preceeding crop could be up to 100 kg/ha of N compared to the natural fallow.

C Results of studies in Nigeria to evaluate the agronomic efficiency of three phosphate fertilizers namely, single super phosphate (SSP), 50% partially acidulated phosphate rock (PAPR) and ground Sokoto phosphate rock (SPR) showed that yields from SPR treatment compared favorably with those obtained with SSP and PAPR. This is interesting since there are large deposits of phosphate rock exists in four sedimentary basins of Nigeria, including the Tullemeden basin of Sokoto state in Nigeria.

C Preliminary results of studies to quantify the nitrogen contributions of groundnuts, and soybean to the preceeding maize crop showed free and effective nodulation with naturally occurring bradyrhizobia in the field at two locations in northern Ghana. Groundnut nodulated more than soybean at both locations. Shoot dry matter yield, an index of N_2 fixation was higher for groundnuts than for soybeans.

C Studies by Burkina Faso on the use of *Parkia biglobosa* pods for *Striga* control has led to the following conclusions:

(a) The powder of *Parkia biglobosa* pods *(Nere)* contain sterols, trytophanes, carotenoides and polyphenolic compounds.

(b) The application of pod powder at the rates of 750g/m^2 and 500g/m^2 at planting ensures soil humidity superior to the non-treated control. However, the two doses did not inhibit nitrification of the soil.

(c) The application of 750g/m^2 and 500g/m^2 of *Nere* powder at planting reduced the *Striga* dry matter production by 59.86% and 34.18%, respectively.

(d) The application of 750g/m^2 and 500g/m^2 of *Nere* powder at planting resulted in increased grain yield of maize of 28.34% and 2.48% respectively, over the non-treated control.

(e) The economic returns for the application of 750g/m^2 of *Nere* powder at planting was found to be 32.08% compared to the non-treated check.

Studies are continuing to identify the principal active ingredients which inhibit *Striga* seed germination and to explore the practical application of the technology.

2.5 PROMOTION OF MARKETING AND ALTERNATIVE USES OF MAIZE

Maize is one of the most productive cereals in West and Central Africa and has diversified uses.

Despite the significant progress that has been made through plant breeding in improving yield, disease and insect resistance of maize varieties, the adoption of improved varieties by farmers in some instances is not as high as desirable. This is partly due to the fact that some of the improved varieties lack the desired quality for processing.

Information regarding the characteristics of maize required for specific end-uses is not easily available. It is believed that lack of information on the processing and utilization of maize is a constraint to the effective marketing and increased production of maize in the sub-region.

There exists enormous potential for the use of maize in the industry, brewery and as animal feed. It is therefore very important to understand the maize distribution and marketing systems as well as the utilization of maize for various items such as oil, flour, grits etc.

The progress made in the development and promotion of alternative uses of maize include the following:

C A project on maize utilization was funded in Mali in 1996 to determine the feasibility of substituting maize flour for wheat flour in the bakery industry in Mali. Preliminary results of the evaluation of two improved maize varieties, Sotuba (Yellow) and Tuxpeno (White) have shown that wheat flour could be substituted with 20%, 40%, 60% and 80% of maize flour for baking baguette, croissant and chocolate cake, respectively. This is expected to result in several millions of dollars of savings from wheat flour imports in Mali.

C A study was funded by WECAMAN to analyze the existing marketing system for maize in northern Ghana. The results showed that maize is an important crop in Ghana in terms of cash and cultural relevance. There are positive private profits in the cultivation of the crop in northern Ghana but inputs and outputs are priced below their social values emphasizing the lack of incentives and hence the motivation to invest in maize production in northern Ghana. Nevertheless long term sustainability of the crop enterprise is promising. The high marketing

margins of over 70% of farm gate prices are an illusion because marketing costs constitute over 50% leaving less than 50% as remuneration for the investment by assemblers, wholesalers and retailers. Because transport cost make up a bulk of the transaction costs, wholesalers are worse hit in terms of reduced remuneration as they transport produce over long distances. It may be recommended that a relative increase in output price through a reduction in input prices may be of immense benefit to maize farmers. The very high transport cost may be attributable to poor road networks hence an improvement in the road network and other logistics may reduce the charge per unit of produce transported. Given that transport charge per unit reduces with increasing quantities transported, traders should pool their goods during transportation if they cannot individually increase their purchases to take advantage of economies of scale. A similar pooling may be considered during storage to take care of excess capacity and thus lower storage costs.

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) *West and Central Regional Maize Workshop*

The biennial West and Central Africa Regional Maize Workshops serve as the fora for exchange of scientific information and technology in network member countries. They also allow the presentation of scientific papers as well as the review of progress reports on collaborative research projects of WECAMAN.

The Tenth Anniversary WECAMAN Workshop was held at IITA, Cotonou, Benin 21-25 April, 1997. The workshop was attended by 60 scientists from the sub-region and representatives from USAID, OAU/STRC, CIMMYT, Sorghum and PASCON Networks, and IITA.

Participants presented and discussed 37 scientific papers selected on competitive basis, 12 lead papers (invited) and eight country reports. A working group appointed to synthesize the findings of the workshop identified the following as the advances made by WECAMAN since 1995:

1. The community seed production schemes supported by WECAMAN are making important contribution towards the availability and distribution of improved seeds especially those of early and extra-early maize varieties which had hitherto been scarce in the sub-region.

2. Donor-supported networking has contributed to scientific research and has made positive impact on food production and poverty alleviation in the sub-region.

3. The first occurrence of oospores of maize downy mildew (*Peronosclerospora sorghi*) has been highlighted. This has now necessitated the international review of scientific knowledge on this

disease.

4. Important studies have been initiated to elucidate the genetic mechanisms governing biotic stresses such as streak resistance and downy mildew in the sub-region.

5. Alternative sources of soil fertility amendments to chemical fertilizers have been studied. Results so far indicate the effectiveness of the use of legumes as cover crops and in crop rotation. The application of rock phosphate and organic manure are also effective.

6. The release of *Tertrisoma nigrescens*, a natural enemy of the larger grain borer, *Prostephanus truncatus*, has made important contribution to the control of this pest.

7. *Striga* tolerant open pollinated populations, varieties and hybrids have been developed.

8. Quality protein maize (QPM) three-way hybrids have been developed in Ghana and tested successfully around the world and promising hybrids have been identified for use in the sub-region and elsewhere.

9. Achievements and advances in maize utilization in different member countries of the network are encouraging.

(ii) *Impact assessment workshops*

In an effort to improve the impact assessment capability and capacity within the network member countries, WECAMAN sponsored a scientist each from Ghana and Nigeria to an impact assessment course in Ghana in August, 1997. Also, a scientist each from Burkina Faso and Mali were sponsored to a similar impact assessment workshop in Burkina Faso in July, 1997.

Each of the scientists is expected to conduct an impact assessment of research on maize production and productivity in the respective countries following the workshop.

2.7 INFORMATION EXCHANGE ACTIVITIES CARRIED OUT BY NETWORK MEMBER COUNTRIES IN 1996/97

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 1996/97:

1. 1995/96 Annual Report of WECAMAN

2. Report of the sixth meeting of the WECAMAN Steering Committee

3. Compilation of the results of the 1996 Regional Variety Trials

4. Report of the fourth meeting of the ad hoc Research Committee of WECAMAN

5. Proceedings of the 1995 Regional Maize Workshop

2.8 IMPACT ASSESSMENT OF RESEARCH ON MAIZE PRODUCTION AND PRODUCTIVITY

One of the major activities of WECAMAN is to constantly monitor the adaptation and release of technologies developed by the network, the area under cultivation and the production levels in member countries during the life of the WECAMAN project so as to determine the impact of the research effort of the network.

In an effort to demonstrate that there are good returns to investments in maize research in network member countries and thereby influence policy on agricultural research, impact assessment studies have been funded by WECAMAN in member countries since 1994.

Impact assessment studies were conducted in Benin in 1995 and in Togo and Cameroon in 1996.

The summary of the conclusions of the impact assessment studies conducted during the period under review were as follows:

CAMEROON

The results of the impact assessment study in Cameroon revealed that:

- Improved varieties of maize have been released in Cameroon during the last decade and have been widely adopted in northern Cameroon. These include CMS 9015, CMS 8806, CMS 8804, CMS 8704 and CMS 8501.

- There is a rapid displacement of sSorghum (the traditional staple crop) by maize.

- The displacement of sorghum by maize is due to several factors including the availability of early maturing varieties, high yield, profitability, better filling capacity and taste.

TOGO

The results of the impact assessment study in Togo showed that the new improved maize varieties, AB II and Amen which are very popular in southern Togo are not known to the farmers in northern Togo. Only the old varieties such as Ikenne and Pozarica which are no more used in southern Togo are cultivated. Since the seed of Ikenne and Pozarica are no more available in the north, farmers have to save their own seed for planting. The yield of the local variety in the Kara region of northern Togo is 0.8 t/ha while the improved maize varieties have an average yield of 3.4 t/ha in the Kara region and 2.2 t/ha in the savanna zone.

Cost-benefit analysis revealed that it is more profitable for the farmers to grow the improved maize varieties than the local varieties in both the Kara region and the Guinea savanna zone. The adoption of the improved maize varieties will result in return to investment of 318.000 FCFA in the Kara region and 227.300 FCFA in the savanna zone as compared to 45.640 FCFA and 71.500 FCFA for the adoption of the local maize varieties in the savanna zone and the Kara region, respectively.

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