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MAIZE TECHNOLOGIES CURRENTLY IN THE PIPE LINE IN WEST AND CENTRAL AFRICA

INTRODUCTION

The collaborative research and regional trials coordinated by the Maize Network have allowed national programmes in West and Central Africa to identify promising varieties and technologies. After further testing of the selected technologies at several locations in individual countries, new technologies have been released and adopted by many farmers. These technologies have helped in extending maize hectarage in all the 17 Network member countries. The savanna belt of West and Central Africa has witnessed large increases in maize production. The early and extra-early varieties promoted by the Network have made significant contribution to the increase in maize production through the movement of maize into new frontiers, as they escape drought and help to bridge the hunger period in July since they mature when other crops are not yet ready.

Beside the success that has been achieved by the maize network in stimulating the initiative and capacity of national scientists to identify and solve production constraints, there are a number of technologies in the pipe line. These would need continued attention after the end of SAFGRAD Phase-II if the goal of self-sufficiency is to be attained. The technologies in the pipe line include:

1) *Striga* tolerant varieties
2) Early, drought tolerant varieties
3) Some new varieties and management practices by the maize network during SAFGRAD Phase II.

It may be noted that apart from the two constraints mentioned above, there are other equally important research areas such as breeding for nitrogen use efficiency, breeding for stem borer resistance and the control of the larger grain borer which would need priority research attention in order to ensure increased maize production and productivity in the sub-region.

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1. BREEDING FOR STRIGA TOLERANT VARIETIES

One of the major biotic constraints to increased maize production in the semi-arid zone of West and Central Africa is the parasitic weed, *Striga hermonthica*. Even though this parasite has always been a serious pest on sorghum, pearl millet, and cowpeas, maize is probably more seriously affected than other cereals largely because the crop is relatively new to the region and has not co-evolved with the parasite. Striga causes not only high yield losses, ranging up to total crop loss, but also it can compel farmers to abandon maize cultivation entirely. The parasite is therefore a big threat to the rapid spread of maize into the semi-arid zone.

IITA has identified sources of moderate resistance to Striga hermonthica and developed effective resistance screening method. Striga sick plots have been established in Ghana, Cameroon and Benin for screening for Striga resistance with the technical assistance of IITA. A number of promising tolerant materials have been identified and are being used in the breeding programmes. Also, evaluation of cultural practices for control of the incidence

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Table 1. Maize production trend in some selected countries of West and Central Africa

Country	Production area (ha)		Grain Production (tons)		% of total maize area under improved varieties in 1988	Technologies adopted by NARS through SAFGRAD
	1986	1989	1986	1989		
Benin	442,785	478,995	352,849	424,042	41	Pirsabak 30-SR, Sekou 81
Burkina Faso	165,000	206,000	155,000	171,000	27	TZSR-W-1, DMR-ESRW, TZESR-W
Cameroon	-	500,000	-	600,000	18	SR-22, KPB, KPB, KPJ, KEB, KEJ, SAFITA-2, Pool 16
Chad	32,419	45,292	25,293	41,000	-	DT, Tied ridging, Ridge tying implement.
Côte d'Ivoire	468,000	600,000	361,000	450,000	10	CMS 8602, CMS 8806, SAFITA-2, Pool
Ghana	472,000	567,000	560,000	750,000	43	16 DT, Mexican 17 Early and Tied
Mali	-	126,000	-	228,000	36	ridging, seed treatment with ST 25.
Mauritania	2,624	11,303	1,150	3,104*	-	Gusau 82 TZESR-W, CSM 8501, CMS 8507.
Niger**	2,194	3,047	4,735	4,776	-	TZSR-Y-A, Maka, Pool 16 DT.
Nigeria	-	3,5 m	-	5,4 m	40-50	SAFITA-2, Okomasa, Abeleehi, Dorke
Senegal	95,000	105,000	100,000	133,000*	100	SR, Streak screening techniques.
Togo	-	258,000	-	245,000	15	Golden Crystal, SAFITA-2,
						DMR-ESRY, TZEE-Y.
						TZESR-W, Maka, Pop 31-SR, JF de Saria.
						DMR-ESRW, DMR-ESRY, TZESR-W.
						Pool 16 DT, Tocument 7835, Maka.
						TZESR-W, DMR-ESRY, TZESR-W.
						Pool 16 DT, Tocumen 7835, Maka.
						TZESR-W x Gua 314, Maka,
						Streak screening techniques.

* 1990 figures

** Production under irrigation

source : - 1989/90 CIMMYT World Maize Facts and Trends.
- Outline of National Maize Research Systems in West and Central Africa.

of *Striga* are in progress in Ghana and Cameroon, while Burkina Faso is working on biological control of *Striga*. A *Striga* working group comprised of Ghana, Benin and Cameroon has been formed by the maize Network and these countries have been assigned *Striga* research responsibilities. *Striga* deserves priority attention during the next phase of the Network and it is expected that the Lead Centres for Striga would be supported to incorporate *Striga* resistance genes into available varieties and breeding materials as well as to continue research into the cultural methods of *Striga* control.

2. BREEDING FOR EARLY, DROUGHT TOLERANT VARIETIES

Rainfall in the semi-arid zone of West and Central Africa is unreliable, unpredictable and varies from year to year. For instance, the Sahelian countries of West and Central Africa were severly affected by exceptional drought during the late 1960's and early 1970's. This resulted in the fall of cereal production by about 600,000 tons, a little less that 15% of the annual harvest in a normal year (Sasson, 1990). In the 1980's, most of the countries of sub-Saharan Africa were once again hit by a severe drought which resulted in fodd shortages in 22 countries, affecting about 250 million people (Farmer and Wigley, 1985). The Sahelian drought has been a persistent feature of the region for more than a decade and largely accounts for the annual fluctuations of maize production in the semi-arid zones. Tolerance to soil moisture stress is therefore an important trait for increased production and productivity in the semi-arid zones.

Breeding for varieties that combine early maturity (90-95 days) with drought tolereance and reasonably good yield became a major breeding goal of IITA/SAFGRAD in 1984. At present, a number of early maturing varieties with moderate levels to several NARS. The varieties include: Across 86 Pool 16 DT and Farako-Bâ 88 Pool 16 DT. There is however, a need for enhancement of drought tolerance and adaptation to attractive to farmers. A programme has therefore been initiated towards this goal.

There is also the need to incorporate drought production in several Network member countries. Furthermore, a programme has been initiated to develop an early maturing, drought tolerant population from landraces that evolved in some West African countries and some improved varieties that have shown good performance under drought stress. The drought tolerant population would be improved through recurrent selection to serve as the source for future drought tolerant varieties.

There is therefore a need to sustain the research effort in order to make available varieties with good levels of drought tolerance for Network member countries.

3. PROMOTION OF THE ADOPTION OF TECHNOLOGIES MADE AVAILABLE BY THE MAIZE NETWORK

An important area in which remarkable progress has been made by IITA/SAFGRAD is the development of maize varieties with good adaptation to bio-climatic conditions of the semi-arid ecologies and resistance/tolerance to major diseases. In Table 2 is presented a list of promising tehcnologies in the pipe line at the Network level while Table 3 shows promising varieties which are at various release testing stages or about to be in member countries of West and Central Africa. Results of the SAFGRAD Regional Uniform Variety, TZEE-W SR, TZEE-Y SR, Maka SR, BDP SR and CSP SR are significantly higher yielding than their non-resistant counterparts. Furthermore, the SR versions are more vigorous and tolerant to other foliar diseases (such as rust, blight and Curvularia leaf spot) than their streak susceptible counterparts. Also, results from the RUVT-early over the past four year showed that there were Pool 16 DT SR varieties which significantly out-yielded the streak susceptible variety SAFITA-3, which has already been released in several member countries. It has therefore been recommended that all countries that have released SAFITA-2 should consider replacing it with Kamboinse 88 Pool 16 DT SR or Farako-Bâ 88 Pool 16 DR SR (HD) in order to ensure yield stability.

Promotion of the new SAFGRAD early and extra-early streak resistant varieties as well as the varieties in the pipe line and released varieties of member countries of the Network, would be vigorously undertaken by the Network. This would ensure adoption of these improved varieties and the achievement fo the goal for food self-sufficiency for the countries in the semi-arid zones.

Towards this end, the following activities/measures are:

Table 2 : Promising Network technologies in the pipe line.

1. Extra-early varieties

Name of Variety

(Across 8131 x JFS) x
Local Raytiri
CSP
CSP-SR
CSP x Local Raytiri
Pool 27 x Gua 314
Pool 28 x Gua 314
Pool 30 x Gua 314
TZEE-W1
TZEE-W2
TZEE-Y
TZEE-Yellow Pool
TZEE-YSR
TZEE-Y
TZEESR-W x Gua 314

2. Early Varieties

Across 90 Pool 16 DT
Farako-Bâ 90 Pool 16 DT
Ina 90 Pool 16 DT
Kamboinse 90 Pool 16 DT
Nyankpala 90 Pool 16 DT
Maka SR

3. Improved agronomic practices

1. Tied ridges for soil moisture conservation in Sudan savanna.
2. Better seed treatment chemicals for improved plant establishment and grain yield.
3. Increased plant population for higher grain yield of early and extra-early varieties.
4. date of fertilizer application (top dressing) for increased yield of early and extra-early varieties.

Table 3. Promising maize varieties in the pipe line for release in West and Central countries.

Country / Name of variety	Origin	Adaptation Area
<u>Benin</u>		
DMR-ESRW	IITA	North
Pool 16 DR	SAFGRAD	North
EV 8328-SR	CIMMYT-IITA	North
<u>BURKINA FASO</u>		
FBC 6	INERA (Burkina)	
KPB		
KEB		
KEJ		
Pool 16 DR		
<u>CAPE VERDE</u>		
Maka	Mauritania/SAFGRAD	
<u>CENT. AFR. REPUBLIC</u>		
CMS 8501	Cameroon	
CMS 8710	Cameroon	
<u>CHAD</u>		
Pool 16 DR	SAFGRAD	Soudan Savanna
CMS 8602	Cameroon	Sudan Savanna
CSP X L. Raytiri F3	SAFGRAD	Sahel
<u>COTE D'IVOIRE</u>		
Maka	Mauritania/SAFGRAD	Center
Pool 16 DR	SAFGRAD	Center
TZEF-Y	SAFGRAD	Center
Ferke 8336	CIMMYT	North
<u>GHANA</u>		
Dorke SR (Pool 16-SR)	CIMMYT-IITA	Country-wide
GH 8363-SR (QPM)	CIMMYT-IITA	Country-wide
<u>GUINEA</u>		
Ikenne 83 TZSR-Y-1	IITA	
EV 8428-SR	CIMMYT-IITA	
IRAT 200	IRAT/CI	
IRAT 292	IRAT/CI	
Poza Rica 8526	CIMMYT	
<u>MALI</u>		
DMR-ESRY	IITA/SAFGRAD	
TZEF-Y	SAFGRAD	
Los Banos 8531	CIMMYT	
Across 8464	CIMMYT	

Table 3. (cont'd)

Country/Name of variety	Origin	Adaptation Area
MAURITANIA		
Gwebi 8422	CIMMYT	
Pool 16 DR	SAFGRAD	
CSP Early	CIMMYT/SAFGRAD	
NIGER		
Composite Kollo 1	Niger	South (Rain-fed)
NIGERIA		
White Composite	IAR & T	
SENEGAL		
Sids 8445	CIMMYT	
Ikenne (1) 8149-SR	CIMMYT-IITA	
TOGO		
AB 11	Togo	
AB 12	Togo	
AB 13	Togo	

proposed to be carried out by the Maize Network beyond the end of SAFGRAD Phase II.

(a) Research for improved cultural practices for early and extra-early varieties

To maintain sustainability in the increased level of maize production, the early and extra-early varieties, made available to member countries, must be managed with all the proven yield-augmenting practices such as pre-planting tillage, tied, ridging, use of crop residues as mulch, fertilizer, use of optimum population density and seed treatment. As a result of agronomic research carried out by the IITA/SAFGRAD resident research and the national programmes of Burkina Faso, Cameroon and Nigeria on the early and extra-early varieties, grower recommendations are presently available for these varieties. Efforts would be made to refine the management practices and develop new agronomic practices. Proven agronomic recommendations would be made available and promoted within Network member countries for adoption to ensure a quantum jump in maize production and productivity. A major effort of the Network during the next phase would be to promote the adoption of the improved early and extra-early varieties and the accompanying agronomic practices in member countries.

(b) Influence of Agricultural Policy

Among the socio-economic constraints to adoption of improved varieties and other technologies by farmers in Network member countries may be mentioned: unavailable and expensive inputs, low and unstalbe maize prices, inadequate or poor seed production and distribution, weak research-extension-farmer linkages, lack of well organized and effective extension services and lack of appropriate on-farm testing programmes. Since past experience has revealed that the improved varieties and agronomic practices promoted by the Network member countries are economically feasible and farmers are willing to adopt them when the agricultural policies of the governments are right, the Network would explore the possibilities of influencing agricultural policies of member countries in order to remove the socio-economic constraints.

To this end, the Network would encourage members to organize activities, such as:

(i) Annual maize workshops: These would involve researchers, extentionists, policy makers and farmers. The objective would be to review research findings, grower recommendations and agricultural policies.

(ii) Annual research planning: This will involve researchers, extentionists and farmers. The objective would be to establish research-extension-farmer linkages to ensure feedback from farmers and extensionists so that the two bodies can influence the research agenda of Network member countries.

4. RETURNS FROM THE ADOPTION OF MAIZE TECHNOLOGIES IN THE PIPE LINE

With the promotion and adoption of early and extra-early varieties with good levels of resistance/tolerance to Striga, drought and streak, an increase of the maize area under production in most of West and Central Africa will occur. It is expected that maize area in most countries would increase by about 50%. If the recommended package of technology involving the improved early maturing, streak resistant varieties and management practices are adopted, it should be possible to achieve an increase of 0.5 t.ha over the present national average yield. The result will be an increase in total maize production ranging from 50 to over 100% in the various countries. If the right agricultural policies are put in place, then sustainable maize production could be anticipated in the semi-arid zone of West and Central Africa.

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