REPUBLIC OF CAMEROON
MINISTRY OF HIGHER EDUCATION
AND SCIENTIFIC RESEARCH
(MESRES)

INSTITUTE OF AGRONOMIC RESEARCH
(IRA)

National Cereals Research (NCRE) and Extension Project

Annual Report 1986

United States Agency for International Development
(USAID)
International Institute of Tropical Agriculture
(IITA)

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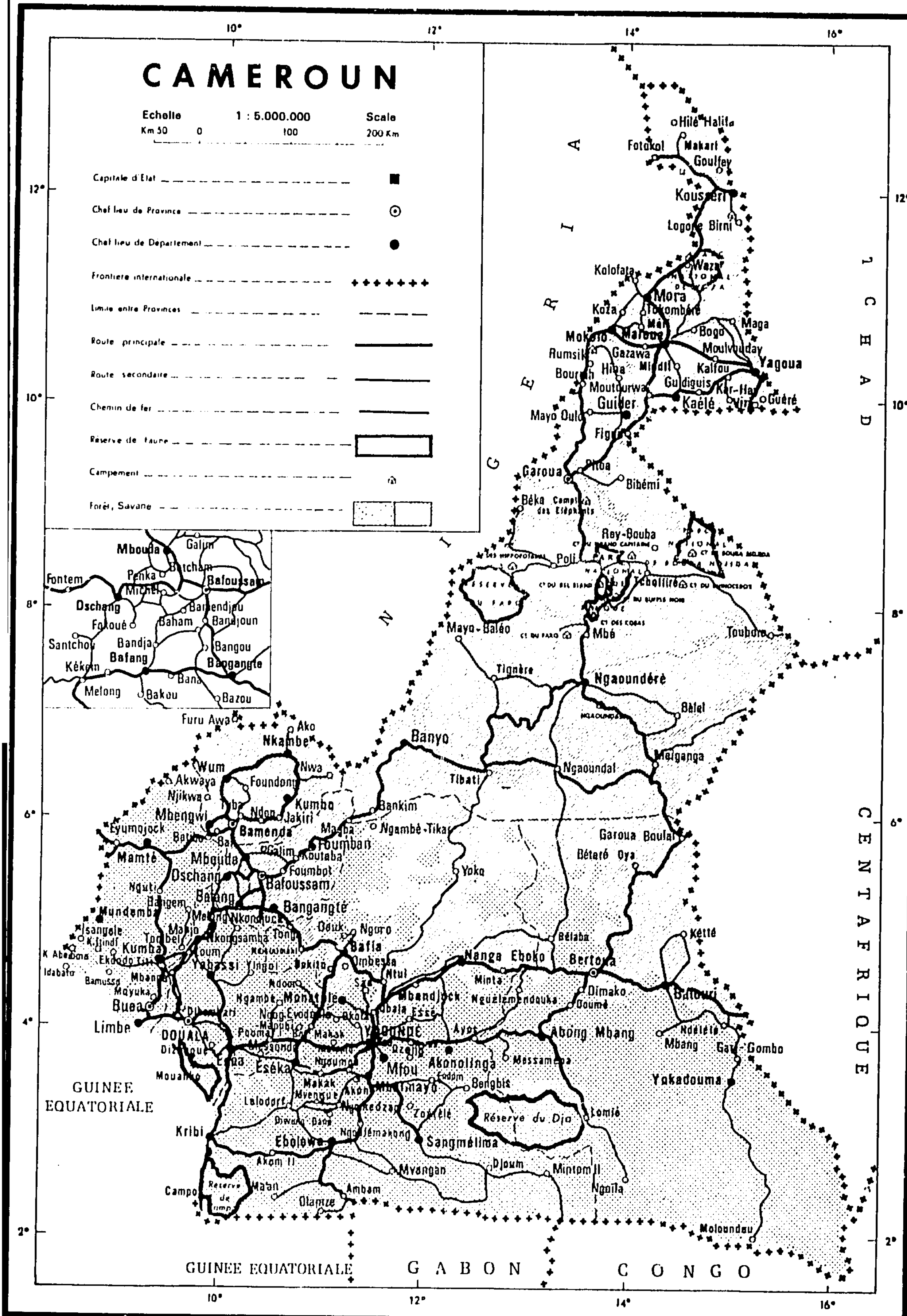

Réalisé par le Centre Géographique National

INTRODUCTION

The results contained in this report were presented at the 1987 joint meeting of the IRA Cereals and Farming systems Program held in Yaounde from February 16 - 20.

This report presents the summary of the research results. It is divided into nine parts: administration, maize breeding (highland and lowland), maize agronomy (highland), sorghum and millet breeding and agronomy, rice breeding and agronomy, cereals agronomy, and the testing and liasion units.

During this joint meeting, all researchers working on cereals and farming systems in the Republic of Cameroon presented and discussed their 1986 research results. At this meeting a critical review of proposed 1987 research operations also took place. Some researchers from international agricultural research centres, e.g. IITA, CIMMITY, ICRAF, etc. and some users of our research results also participated at the meeting.

ADMINISTRATION

INTRODUCTION

The project administration's role is to provide the necessary logistical and financial support to the IITA research staff to permit them to carry out their particular research objectives. It does this by operating as the liaison between the researchers and IITA, IRA, and USAID for their needs of materials, funds, and personnel. Constraints are mainly associated with the problems involved in dealing with the different groups which have different interests and objectives in the project, and the problems of communication given the distances separating the different groups.

Constraints which had the largest impact during the past year were delays in receiving operating funds and materials, specifically research equipment and vehicles. Concerning operating funds, there were problems in clearing and crediting checks from IITA into our local bank account, a procedure which normally takes one month. The equipment delays were a result of the long procedure involved in U.S. procurements. If an order arrives in the U.S. and is not complete, a great deal of time is lost in corresponding the necessary information.

OUTPUT

A. Procurement

The following major commodities were received in 1986:

- Two tractors and accessories for Bambui
- Two Land Cruisers and two Renault R-12s, all station wagons
- Nine sets of household furniture
- One IBM AT personal computer with printer

Outstanding orders included the rest of the computers (8), and various research equipment ordered in May 1985.

B. Personnel

A computer operator was hired in February and has undergone on-the-job training to familiarize himself with the various computer programs used by the project. The administrative assistant hired in June has completed his trial period successfully and has fully assumed his duties. A replacement secretary was hired in April by IRA for the project.

C. Meetings/Visits

IRA Farming Systems and Cereals Programs Planning meeting, two quarterly meetings and the NCRE highland maize field tour were organized.

D. Recruitment and Orientation

Four researchers were recruited and hired for the project. These individuals were given orientation and briefings upon their arrival to familiarize themselves with the project and the research workplan.

The tragic death of one of these researchers caused a major setback in the plans of the project for the Ekona site and was a blow to morale throughout the project.

GENERAL STATEMENT

Although the main research activities were executed during the year, this is not sufficient grounds for evaluating the administration's support role. One must also consider the surrounding circumstances in which this support was carried out. Improvements can certainly be made to help counter the effects of the constraints mentioned above. A common complaint of all the research staff was a lack of reliable vehicles. Provided requests for replacement vehicles are executed as planned, this problem should be alleviated in the coming year. Also, other methods of obtaining operating funds will be tested in an attempt to improve the efficiency of transferring funds. The procurement procedure will also be analyzed to improve its operation.

1986 BUDGET AND EXPENDITURES - LOCAL COST FINANCING

Category	Budgeted $ US	Actually Spent $ US
Rental Housing/Maintenance	138,300	141,147
Local Staff Salaries	80,800	44,199
Local Office Supplies/Expenses	37,100	74,628
Local Equipment Purchase	10,000	12,774
In-Country Travel-Support Staff	17,000	9,759
In-Country Travel-Prof. Staff	109,800	77,909
Fuel	52,000	32,694
Vehicle Maintenance/Repair	68,000	40,482
Research Costs/Temp. Labor	34,000	11,087
Research Costs/Supplies	48,000	28,282
Extension Costs (TLU)	64,800	314
In-Country Training (TLU)	46,800	0
TOTAL	706,600	473,275

A. Remarks

Most of the budget categories were largely underspent. Exceptions being rental housing and office expenses. The high cost of housing was not foreseen and houses that were to be built or provided have not been realized. In office expenses, there was approximately $ 30,000 US resulting from exchange rate difference on a check that was lost by the bank. This was reported in the October 1986 imprest report.

Large underspending was reported in the TLUs. This was due to understaffing and also errors in expense reporting. TLU expenses were often recorded as research costs.

HIGHLANDS MAIZE BREEDING

INTRODUCTION

In 1986, the third year of the NCRE Highlands Maize Breeding Unit, preparation of new populations for long term recurrent selection was continued. The hybrid program emphasized testing of the first generation of single cross hybrids.

Variety Trials

Available varieties had been sufficiently tested in previous years so advanced variety trials were suspended until the new generation of MSR varieties becomes available in 1987. Ear to row selection-seed increase of the introduced variety Shaba was continued at Mbang-Mbirni (formerly called Mbang Mboum) for the Adamaoua Plateau.

Introduction Screening

A small screening trial of 12 entries promoted from a 1985 nursery screening of a collection of 40 from the Iowa State Plant Introduction Station was planted at four locations. Two locations were harvested (Santa-1600m altitude and Babungo-1100m). Three entries, Teko Yellow (210405), Sahara (233335) and an unnamed Tennessee source (221841), showed sufficient disease resistance and yield to be of future interest.

Population Improvement

Based on screening trials in 1984, f[illegible] new populations were formed or selected. Progress in 1986 included :

1. High Altitude Population -- The third recombination was made at Bambui Station as an ear to row isolation. Half sib family recurrent selection will begin in 1987 at high altitude sites.

2. Acid Tolerant Population -- The third recombination was made at Bambui Plain, also as an ear to row isolation. Half sib family selection will begin in 1987 on an acid site.

3. Early White Population -- The second cycle of replicated family selection in Cameroon in CIMMYT Population 34 was made at Babungo in 1986A, and selections were recombined in 1986B. In an effort to identify donors of disease resistance and yield for this population, testcrosses to several introductions and inbreds were made for testing in 1987.

4. Short Late Population -- Ear to row selection-seed increase was made in the variety Kasai at Foumbot, 1986A. Potential donors (including inbreds) of good agronomic traits were testcrossed onto Kasai for testing in 1987.

In addition to the above populations, several low altitude populations are being improved for disease resistance for eventual use as source populations (seed Variety Cross Trial):

1. Eto (population 32) was received from CIMMYT as S2 lines. These were selected and selfed at Foumbot in 1986A, and recombined in 1986B.

2. Tuxpeno -- EV 49 SR (BC 2) was reselected as half sib families at Babungo, 1986A, and selections recombined in 1986B. EV 49 SR was crossed with EV 8443 SR in 1986B to obtain a Tuxpeno with intermediate plant height and high yield. EV 49 SR x MSR BC1 families were selected and selfed at Bambui Plain in 1986A, and the BC2 was formed in 1986B.

Inbred-Hybrid Program

Inbreds selected in 1985 testcross trials were tested as single cross hybrids in 1986. The best 16 parents of these hybrids were recombined (1986B) as two reciprocal synthetics to provide the second cycle of inbreds. The synthetics were also crossed onto major East African hybrids to begin extraction of new inbreds. Extraction of new inbreds continued from Population MSR and from crosses of MSR with other materials as well as from single crosses. Testcrosses of two single crosses representing the synthetics were made onto S2 and S3 MSR lines for 1987 trials.

Trials of 220 single cross hybrids were planted at 4 locations. Growth was good at Foumbot, SODEBLE, and Mbang Mbirni. Approximately 5% of the hybrids were superior to the best open pollinated variety check in all agronomic characters and are thus candidates for release. Results of the 3 best of the 5 hybrid sets (best entries plus checks) are shown in Tables 1-6. Additional testing of the selected single crosses as well as of 3 and 4-way cross hybrids from the same inbreds will be run in 1987. Many of the 1986 selections will be discarded on the basis of seed production difficulties.

Variety Cross Trial

The Variety Cross Trial, first run in 1985, was continued in 1986 with some changes in entries. The objective is to test combining patterns of major source populations for the mid-altitude zone. The trial was successful at Foumbot (1000m), Babungo (1100m), SODEBLE (1500m) and Santa (1600m). Tables 7-8 present results for the crosses among Populations 43, 32, MSR, Kitale 2, and EC 573. Tables 9-10 present results of all parents *per se* as well as all other crosses. Performance differences are somewhat inflated due to substantial differences in plant height (competition) among entries in 2-row plots. It also appears that the cycle and seed source of EC 573 and Kitale 2 used in this trial may be somewnat inbred, affecting yield of the populations per se but not that of the crosses.

Principal conclusions from the Variety Cross Trial in 1986 are :

1. For the mid-altitude zone (1000-1500m), lowland populations Tuxpeno and Eto crossed with highland populations Kitale 2 and EC 573 appear to be a good combination pattern for yield and plant type. Crosses with Population 43 appear best for yield in this respect, but are still too tall.

2. Above 1500m the lowland populations appear less attractive in crosses.

3. EC 573 conveys a very high level of resistance to *Puccinia sorghi*, even in crosses with sensitive material.

J. Eta-Ndu, M. Ndioro, Z. Ngoko, L. Everett

Table 1 : Hybrid set 1 (top entries + checks), Yield (T/Ha).

VARIETY*	Location: FOUMBOT	MBANG	SODEBLE	MEANS
M122 x C15	9.2	11.4	9.8	10.1
C15 x M138	8.5	11.1	9.3	9.6
N100 x M122	9.6	9.9	9.0	9.4
M138 x Z100	9.2	9.8	9.0	9.3
M128 x M84	8.9	9.5	9.5	9.2
N100 x M35	8.5	9.6	9.2	9.1
C15 x N100	8.1	10.1	9.0	9.1
C71 x M122	8.5	9.4	9.3	9.1
Z100 x M122	9.5	8.5	8.9	9.0
M35 x C35	9.0	10.0	7.7	8.9
SHABA	7.5	9.0	7.5	8.0
COCA	6.0	8.1	7.1	7.1
LOCATION MEAN	7.8	8.8	7.7	
S.E.	.473	.466	.412	
CV	10	9	9	
LSD .05	1.3	1.3	1.2	1.1**

* 49 Entries in Trial

** Location x Variety Interaction used as error.

Table 2 : Hybrid set 1 (top entries + checks). Across location means.

VARIETY*	EAR HEIGHT (cm)	ROOT LODGE (1-5)	STALK LODGE (1-5)	EAR ROT (1-5)	MOISTURE (%)	YIELD (T/HA)
	Character					
M122 X C15	145	2.0	3.2	3.3	31.3	10.1
C15 X M138	146	2.8	3.0	2.6	29.0	9.6
N100 X M122	137	1.7	2.8	2.3	24.4	9.4
M138 X Z100	137	2.4	2.7	2.4	25.0	9.3
M128 X M84	145	2.3	2.4	2.1	25.6	9.2
N100 X M35	125	1.3	1.7	1.6	24.3	9.1
C15 X N100	145	1.6	2.3	1.9	28.7	9.1
C71 X M122	147	2.2	2.1	2.4	28.7	9.1
Z100 X M122	140	2.0	2.3	2.3	24.8	9.0
M35 X C35	130	1.1	1.1	2.0	27.6	8.9
SHABA	129	2.2	1.9	2.8	28.2	8.0
COCA	149	2.9	3.2	3.3	26.5	7.1
LSD .05	14**	0.8**	0.7**	0.6**		1.1**

* 49 Entries in Trial

** Location x Variety Interaction used as error.

Table 3 : Hybrid set 3 (top entries + checks) Yield (T/Ha)

	Location			
VARIETY*	FOUMBOT	MBANG	SODEBLE	MEANS
S85 X C70	8.9	9.7	9.5	9.4
C70 X Z7	8.4	9.6	9.7	9.2
C70 X M118	8.4	9.9	8.9	9.1
M84 X Z109	8.9	10.8	7.4	9.0
Z25 X M121	9.0	10.2	7.7	9.0
N100 X Z25	8.4	10.0	8.1	8.8
Z95 X M121	9.2	9.1	8.1	8.8
Z27 X C15	7.7	9.5	8.5	8.6
S64 X M121	8.1	10.0	7.6	8.5
N100 X Z109	8.2	9.7	7.9	8.5
N100 X S64	8.0	8.9	8.4	8.4
Z27 X N100	8.7	8.8	7.8	8.4
SHABA	8.3	8.3	7.2	7.9
COCA	6.3	8.9	7.2	7.5
LOCATION MEAN	7.8	8.8	7.4	
S.E	.459	.349	.379	
CV	10	7	9	
LSD .05	1.3	1.0	1.1	1.0**

* Entries in Trial

** Location x Variety Interaction used as error.

Table 4 : Hybrid set 3 (top entries + checks), Across location means.

VARIETY*	EAR HEIGHT (cm)	ROOT LODGE (1-5)	STALK LODGE (1-5)	EAR ROT (1-5)	MOISTURE (%)	YIELD (T/HA)
	Character					
S85 X C70	124	1.8	2.0	2.3	26.2	9.4
C70 X Z7	140	1.9	1.2	1.8	28.3	9.2
C70 X M118	137	2.3	1.6	2.0	24.8	9.0
M84 X Z109	134	2.7	2.4	2.2	28.6	9.0
Z25 X M121	148	2.4	3.2	3.2	27.1	8.8
Z95 X M121	132	2.4	2.4	2.9	24.8	8.8
N100 X Z25	148	1.6	2.0	2.1	24.9	8.6
Z27 X C15	123	1.0	1.0	2.0	29.6	8.5
S64 X M121	138	3.0	2.0	3.3	27.0	8.5
N100 X Z109	128	2.0	2.4	2.4	23.6	8.4
N100 X S64	143	1.9	1.3	2.2	26.0	8.4
Z27 X N100	126	1.1	1.2	2.1	25.6	8.4
SHABA	121	2.0	1.8	3.1	27.2	7.9
COCA	138	2.8	3.0	3.3	26.9	7.5
LSD .05	14**	0.6**	0.7**	0.7**		1.0**

* 49 Entries in Trial

** Variety x Location Interaction used as error.

Table 5 : Hybrid set 4 (top entries + checks), Yield (T/Ha)

VARIETY*	FOUMBOT	MBANG	SODEBLE	MEANS
	Location			
S62 X M131	9.0	8.6	10.8	9.5
M131 X C70	8.5	9.5	9.5	9.2
C15 X Z23	9.3	9.1	8.7	9.0
Z27 X Z23	8.3	8.2	10.4	9.0
M128 X S62	8.3	7.8	9.8	8.6
M128 X C6	8.0	7.9	9.7	8.5
M84 X M138	7.6	8.4	9.0	8.4
Z94 X Z23	7.7	8.7	8.5	8.3
Z23 X C16	8.1	9.0	7.5	8.2
Z23 X C71	8.0	8.3	8.3	8.2
SHABA	7.4	8.0	8.0	7.8
COCA	5.4	7.2	7.4	6.7
BAB (1) MSR	6.6	6.2	7.0	6.6
LOCATION MEAN	7.2	7.2	8.0	
S.E	.354	.585	.408	
CV	8	14	9	
LSD .05	1.0	1.6	1.1	1.1**

* 49 Entries in Trial

** Location x Variety Interaction used as error.

Table 6 : Hybrid set 4 (top entries + checks), Across location means.

VARIETY*	Character EAR HEIGHT (cm)	ROOT LODGE (1-5)	STALK LODGE (1-5)	EAR ROT (1-5)	MOISTURE (%)	YIELD (T/HA)
S62 X M131	141	2.0	2.4	2.3	29.9	9.5
M131 X C70	138	2.0	2.1	2.4	28.5	9.2
C15 X Z23	138	2.2	1.9	2.1	30.4	9.0
Z27 X Z23	131	1.1	1.1	1.3	29.0	9.0
M128 X C62	137	2.1	2.0	1.8	28.8	8.6
M128 X C6	119	1.2	1.8	2.6	27.8	8.5
M84 X M130	145	3.2	3.2	3.1	27.6	8.4
Z94 X Z23	124	2.3	2.6	2.1	27.4	8.3
Z23 X C16	137	1.9	1.7	1.6	26.5	8.2
Z23 X C71	126	1.9	2.0	1.8	30.7	8.2
SHABA	114	2.1	1.9	2.7	29.4	7.8
COCA	151	2.8	2.9	2.3	28.2	6.7
BAB (1) MSR	128	1.9	2.3	3.1	28.2	6.6
LSD .05	13**	0.7**	0.8**	0.6**		1.1**

* 49 Entries in Trial

** Location x Variety Interaction used as error.

Table 7 : Variety cross trial, Yield (T/Ha).

VARIETY*	Location: BABUNGO	FOUMBOT	SODEBLE	SANTA	MEANS
KIT 2 X 43 SR	10.8	13.5	10.8	9.2	11.1
EC 573 X 43 SR	10.0	11.5	11.2	11.1	10.7
EC 573 X KIT 2	7.9	11.4	10.6	12.6	10.6
MSR X KIT 2	9.5	11.7	10.4	10.6	10.5
MSR X EC 573	9.3	9.8	10.5	10.3	10.0
KIT X 32	8.7	11.6	9.7	9.6	9.9
EC 573 X 32	8.0	10.3	9.6	9.8	9.4
EC 573 X 49 SR	9.1	8.7	9.2	9.9	9.2
KIT 2 X 49 SR	8.3	10.0	8.6	8.3	8.8
43 SR X 32	8.3	10.6	8.0	5.4	8.1
MSR X 43 SR	7.6	9.8	8.6	5.6	7.9
MSR X 32	7.4	8.8	7.8	6.5	7.6
LOCATION MEAN	7.3	9.1	8.1	6.8	
CV	12	11	10	11	
LSD .05	1.2	1.4	1.2	1.0	1.6**

* 12 of 33 entries

** Variety x Location Interaction used as error.

Table 8 : Variety cross trial.

VARIETY*	Across Location Means					SANTA
	DAYS TO SILK	EAR HEIGHT (cm)	PLANT ASPECT (1-5)	ROOT LODGING (1-5)	EAR ASPECT (1-5)	P. SORGHI (1-5)
KIT2 X 43SR	80	158	2.8	1.7	1.4	2.3
EC573 X 43SR	82	164	2.4	1.4	1.3	1.5
EC573 X KIT2	87	191	3.9	2.8	1.1	1.0
MSR X KIT2	79	158	2.9	2.1	1.6	1.8
MSR X EC573	81	162	2.9	1.6	1.4	1.3
KIT2 X 32	81	155	2.7	1.1	1.8	2.1
EC573 X 32	81	147	2.5	1.6	1.6	1.1
EC573 X 49SR	78	141	1.8	1.3	1.8	1.0
KIT2 X 49SR	78	135	2.4	1.6	2.1	2.3
43SR X 32	78	122	1.9	1.2	2.4	3.4
MSR X 43SR	80	133	2.1	1.4	2.5	3.1
MSR X 32	78	133	2.6	1.5	2.4	2.5
LSD .05	2**	15**	0.9**	0.4**	0.6**	0.4

* 12 of 33 entries

** Variety x Location Interaction used as error.

Table 9 : Variety cross trial, Yield (T/Ha).

VARIETY*	Location BABUNGO	 FOUMBOT	 SODEBLE	 SANTA	 MEANS
KIT 2 X 21	9.2	12.6	10.6	8.4	10.2
EC 573 X 21	8.1	9.3	9.9	10.9	9.6
KIT 2 X 34	7.2	9.4	8.5	8.0	8.3
EC 573 X 34	7.9	9.1	8.6	6.5	8.0
MSR X 21	8.2	9.0	8.7	5.4	7.8
MSR X 34	7.2	9.4	7.7	5.6	7.5
49SR X 32	7.9	9.1	8.0	4.9	7.5
MSR X 47 SR	6.8	8.5	7.5	6.3	7.3
21 X 32	7.0	8.2	8.1	4.6	6.9
43 SR X 34	6.5	9.3	6.6	4.4	6.7
34 X 32	5.6	8.5	7.0	4.5	6.4
21 X 34	6.1	8.3	6.7	2.7	5.9
49 SR X 34	5.6	6.9	5.9	4.2	5.6
KIT 2	5.8	8.3	7.8	8.2	7.5
MSR	6.7	8.6	6.6	6.7	7.1
43 SR	7.9	9.4	7.2	3.7	7.1
21	5.7	8.4	7.7	2.8	6.1
32	5.0	5.7	6.1	3.4	5.1
EC 573	2.4	4.0	5.2	7.1	4.7
34	4.0	5.9	5.0	3.6	4.6
49 SR	4.2	5.4	5.0	2.8	4.3
LOCATION MEAN	7.3	9.1	8.1	6.8	
CV	12	11	10	11	
LSD .05	1.2	1.4	1.2	1.0	1.6**

* 21 of 33 entries

** Variety × Location Interaction used as error.

Table 10 : Variety cross trial.

	Cross Location Means					SANTA
VARIETY*	DAYS TO SILK	EAR HEIGHT (cm)	PLANT ASPECT (1-5)	ROOT LODGING (1-5)	EAR ASPECT (1-5)	P. SORGHI (1-5)
KIT2 X 21	81	157	2.8	2.0	1.9	2.4
EC573 X 21	83	153	2.5	1.7	1.4	1.1
KIT2 X 34	79	132	2.6	1.8	2.3	2.1
EC573 X 34	79	138	2.4	1.4	1.9	1.3
MSR X 21	77	129	2.5	1.4	2.2	3.6
MSR X 34	79	131	2.6	1.6	2.8	2.8
49SR X 32	75	103	2.4	1.1	2.9	3.3
MSR X 49SR	79	126	2.6	1.5	2.3	2.9
21 X 32	78	116	2.5	1.4	2.8	3.4
43SR X 34	77	116	2.3	1.2	2.7	3.4
34 X 32	78	109	2.6	1.2	2.6	3.4
21 X 34	75	114	2.9	1.3	3.1	3.9
49SR X 34	77	99	3.1	1.2	3.1	3.4
KIT2	85	182	3.7	3.1	2.2	1.0
MSR	79	134	2.8	1.8	2.6	2.3
43SR	83	140	2.4	1.1	2.3	3.1
21	80	127	2.9	1.4	2.8	3.9
32	77	107	3.1	1.6	3.1	2.9
EC573	92	185	3.8	2.6	3.4	1.0
34	75	92	3.3	1.3	3.3	3.6
49SR	75	88	3.4	1.3	3.4	3.6
LSD .05	2**	15**	0.9**	0.4**	0.6**	0.4

* 21 of 33 entries

** Variety x Location Interaction used as error.

LOWLAND MAIZE BREEDING PROGRAM

1. INTRODUCTION

The lowland maize breeding program provides the varieties for all areas in Cameroon that are less than 1000 meters above sea level in elevation. To achieve this goal the program has three components: Variety Testing and Recommendation, Population Improvement, and Breeder and Foundation Seed Production. Variety testing is done in all provinces except Ngaoundere. Last year, five open-pollinated varieties were released by the program for on-farm testing. All are streak resistant and vary in crop cycle from 90 to 120 days. Three of these namely CMS 8501 C_1 (90 days), CMS 8503 C_1 (105 days) and CMS 8507 C_1 (112 days) performed well and will be further tested in farmers' fields.

Rainfall in 1986 was generally greater than the 1982-86 five year average (Table 1). There was more precipitation in the Sudan and South Sahel Savannah in 1986 than in 1985. However, rainfall in the North Guinea Savannah in 1986 is slightly less than in 1985 but sufficient for a good crop. There was a two week moisture stress between July 16 to August 15 in most Sudan and South Sahel areas and in Tchollire. This reduced the yield of the trials in these sites.

In the forest zone, rainfall was more than adequate during the first season. However, the second season was short with no rains after November 26 in many areas.

During the 1986 season diseases were of minor importance in the forest zone. On the other hand, in the savannah zones there were heavy infestations of the parasitic weed <u>Striga spp.</u> and termites. Streak was very minimal in 1986.

II. O U T P U T

SUB-GOAL	OUTPUT
A. MAIZE BREEDING	
1. Production of breeder (BS) and foundation (FS) seeds of recommended varieties.	- Produced 11 kg BS - Produced 650 kg FS
2. Development of superior streak resistant varieties.	- Released for on-farm testing five streak resistant varieties.
3. Development of two additional gene pools for use in long term breeding.	- Identified Ik. (1) 8149-SR and BSR 81 to be highly heterotic to NCRE 8401 (Pool 1). - Identified BSR 81 and Bafia to be heterotic to IK (1) 8149-SR and Pool 16 SR.
4. Population improvement to improve agronomic characteristics of superior populations.	- One cycle mass selection for local adaptability was done on CMS 8501 C_1, CMS 8503 C_1 and CMS 8507 C_1.
5. Development of varieties tolerant to drought.	- One cycle mass selection for high density at 95 thousand plants/ha (TPPH) on CMS 8507 C_1. - Two cycles of mass selection on CMS 8501 C_1 at 82 and 111 TPPH.
6. Development of early maturing varieties.	- Development of CMS 8501 C_2 (80 day variety) from CMS 8501 C_1.
7. Development of varieties for use intercropping.	- One cycle mass selection for prolificacy in CMS 8507 C_1.
B. G E N E R A L	
1. Institutional development	- Provided on the job training to Messrs. Zonkeng, Njume, Mrs. Teke.

- Advised Drs. Almy, Poku, Tonye and Talleyrand on the conduct of agronomic and/or on farm trials involving maize.

- Conducted cooperative trials with MIDEVIV, Karewa and PROSEM

- Improved seed storage and field facilities for maize breeding i Nkolbisson.

- Conducted cooperative trials with IITA, SAFGRAD and CIMMYT.

2. Professional improvement

- Attended the American Society of Agronomy and American Seed Trade Association meetings.

3. Home Leave

III. GENERAL STATEMENTS

1. Accomplishments

1.1 Development of streak resistant CMS 8507 C_1, 8503 C_1 and 8501 C_1 as replacement for streak susceptible TZPB K81 and Mexican 17E as varieties for the savannah.

1.2 Production of about a ton of breeder and foundation seeds of above three varieties for use in agronomic and extension trials.

1.3 Development of breeding populations that are necessary for long term variety development program.

2. Opportunities

1. The development of streak resistant varieties, CMS 8507 C_1, CMS 8503 C_1 and CMS 8501 C_1 for use in the savannah will prevent losses due to streak infestation. Seeds of the three varieties will be increased by Project Semencier for use by researchers.

2. The use of CMS 8501 C_1 a 90 day variety as green maize is a potent weapon against hunger in the North and Far North Provinces during the hungry period which starts in late July until the regular crop of sorghum and millet are harvested in end of September.

3. CMS 8501 C_1 being early maturing will also be a good variety for evading drought and will enable farmers to plant late thus fitting the cotton-peanut-maize planting sequence of SODECOTON farmers. CMS 8503 C_1 which with its short stature and resistance to shading and CMS 8501 C_1 because of its earliness will also be advantageous to use in many cropping systems common in the forest zone.

4. The availability of CMS 8501 C_1 will enable rice farmers in the Northwest Provinces to go on double cropping by planting the above variety in March to be harvested in July prior to the planting of the rice crop.

Similarly, the muskwari farmers in the North can plant a maize crop in June for harvest in September prior to planting the muskwari crop starting late September.

3. Problems Encountered

1. Persistent lack of money from August to December.

2. Frequent breakdown of our vehicle and delays in arrival of spare parts.

3. Insufficient fuel and labor budget in IRA Stations for IRA personnel.

4. Lack of seed processing space in Nkolbisson.

4. Publications

Empig L.T., C. The and C. Zonkeng. 1986. Potential of maize introductions as varieties in the lowland zones of Cameroon. Abstracts 1986 proceedings of the America Society of Agronomy.

IV. DATA

1. VARIETY TESTING AND RECOMMENDATION

Prior to release for on-farm testing, selected varieties undergo three years of testing. The first of the three series of tests is the Experimental Variety Trial (EVT), followed by the Elite Experimental Variety Trial (EEVT) the following year. In the third year, outstanding entries in the EEVT are finally tested in the National Variety Trial (NVT). For 1986, a total of 60 trials were planted by the program.

1.1 National Variety Trial (NVT)

The NVT intermediate/late group (I/L) was planted in seven locations three of which were in the forest zone and two each in the Sudan and North Guinea Savannahs. Late varieties silked later than 55 days after emergence (DAE) while intermediate entries flowered between 45 to 55 DAE. The yields in the forest zone are shown in Table 2. The results further confirmed previous data on the superiority of Gusau TZB-81, and Populations 43 and 22 in the forest zone. The data also shows the potential of CMS 8503 C_1 (Population 49) as an intermediate variety having a crop cycle of 105 days as against 112-120 for the above other three varieties.

Table 3 shows the yields of the entries in the NVT (I/L) group in the savannah locations. The results again showed the superiority of Gusau TZB-81, Populations 43 and 22 and Suakoko TZPB-81 in the savannah areas. Similarly, CMS 8503 C_1 showed good potential as an intermediate maturing variety.

The early group of the NVT were grown in four environments (2 forest and 2 savannah). The entries in this group silk less than 45 DAE. The yields of the various entries are shown in Table 4. Significant differences in yield were obtained in Ntui during the first season and in Makebi. All the entries were better than the check in Ntui while CMS 8501 C_1 was significantly better than all entries in Makebi. Only CMS 8501 C_1 was better than the check in both trials where significant differences were observed.

1.2 Elite Experimental Variety Trial (EEVT).

Two trials of the EEVT were made all belonging to the Intermediate/Late group. The first trial was conducted in Fignole and Table 5 shows that the Quality Protein Populations (QP) namely: PR. 8464, ACROSS 8464, EV. 8540 SR-BC_4 and SUWAN 8464 had yields comparable with CMS 8507 C_1. It is necessary to confirm these results in the NVT since the use of QP Populations will increase the nutritional value of maize as food or feed material. Synthetics A, 3 and 4 also showed good potential as germplasm source.

1.3 Experimental Variety Trial (EVT).

New germplasm collected by the project are tested in the EVT. Similarly, cooperative trials with IITA, SAFGRAD and CIMMYT are also included in this group but the trials are planted separately to allow the above institutions to have a combine analysis over all their testing sites.

1.31 SAFGRAD Trials

Regional Unified Variety Trials (RUVT) are the cooperative trials from SAFGRAD. In 1986, there were three trials namely, RUVT-1 (Early); RUVT-2 (Intermediate) and RUVT-3 (Extra Early).

RUVT 1 was planted in Sanguere and in Maroua, and Table 6 shows that significant differences were observed in Sanguere only. The top four entries are already in our collection.

RUVT 2 was grown in Fignole and as shown in Table 7, the top two entries are CMS 8507 C_1 and EV. 8422-SR. The latter is also in our germplasm collection.

RUVT 3 trials were conducted in Sanguere and Maroua. Table 8 shows that the top entry in both locations are our own varieties CMS 8501 E_1 and CMS 8503 C_1. However, three varieties namely, POP. C.S.P., KITO and KAMANDAOGO TOLLO were selected for earliness and yield potential and will be included in our germplasm collection. The other agronomic characteristics of the entries are shown in Tables 8a and 8b.

1.32 IITA Tests

In 1986 three sets of trials were obtained from IITA. These were EVT-ESR-W, EVT-LSR-W and EVT-LSR-Y. The first was planted in Sanguere and Soucoundou, the second in Njombe and Karewa and the third in Bertoua. No significant differences were obtained in both EVT-ESR-W trials (Tables 9). In the EVT-LSR-W, trial in Njombe the 1984 cycles of populations 22 and 43 were the top yielders but only the former is significantly better than NCRE 8401 (Table 10). Population 22 is the male parent in the crosses involving four other varieties used in the formation of NCRE 8401. No significant differences were observed in the EVT-LSR-W trial in Karewa (Table 11). Results of the EVT-LSR-Y trial is shown in Table 12. All the top five entries are in our collection.

1.33 CIMMYT Trial

In 1986, only one trial came from CIMMYT. The test was EVT 15A - D4 which is composed of "Quality Protein Materials" (QPM) and was planted in Bertoua and Mayo Galke. The yields of the entries in the two locations are shown in Table 13. Significant differences were observed only in Mayo Galke and many QPM materials had statistically the same yield as Gusau TZB SR. These outstanding QPM entries should be further tested so they can be used later as varieties or breeding materials.

1.4 Varietal Recommendations

In 1985, the program released five varieties for on farm and agronomic trials. The varieties and their major agronomic characteristics are as follows :

VARIETY	SOURCE POPULATION	ENDOSPERM CHARACTERISTIC	DAYS TO SILK	CROP CYCLE (DAYS)
CMS 8501 C_1	POOL 16-SR	FLINT/DENT	43	90
CMS 8503 C_1	EV. 8249-SR	DENT	49	105
CMS 8505 C_1	IK. (1) 8243-SR	DENT	52	110
CMS 8507 C_1	GUSAU TZB-SR	FLINT/DENT	53	112
CMS 8509 C_1	TZPB-SR	DENT	58	120

The above varieties were again tested in the NVT and in the advanced tests in 1986. The main objective of the various tests is to determine if the above populations are better than their streak susceptible counterparts or if they can replace existing varieties.

Fig. 1 shows the performance of CMS 8507 C_1 and Gusau TZB 81 in seven NVT locations in 1986. Differences in yield between the two varieties were not statistically significant except in Mayo Galke and Njombe. Therefore, CMS 8507 C_1 should be promoted instead of Gusau TZB 81 since the former is streak resistant.

The summary of the results of the Advanced Yield Tests conducted in the savannah locations are shown in Table 14. Significant differences were observed in Sanguere with CMS 8507 C_1 yielding better than the other CMS populations. Both tests in Karewa were not significant. In the forest zones, two advanced tests were conducted. In Ngoumou, where the pH of the test area was 4.6, Improved Ekona White gave the highest yield (Table 15). In Mbandjok, where pH was 4.9 and nitrogen fertilization was at the rate of 140 Kg/Ha, no significant differences were observed.

Comparative yields between CMS 8501 C_1 and Mexican 17E in five trials in 1985 and 1986 are shown in Table 16. The superiority of CMS 8501 C_1 was also observed in three agronomy trials in 1986. Therefore, we would like to recommend that CMS 8501 C_1 should be used instead of MEX. 17E in the Sudan and South Sahel Savannah since it is early maturing, streak resistant and higher yielding.

2.0 HYBRID TRIALS

Three sets of the International White Hybrid Trials were planted in 1986. The summary of the yields of the entries in the three sites are shown in Table 17. Differences in yields among entries were observed only in Karewa and no hybrid yielded significantly better than Gusau TZB-SR.

In 1985, the results of the White Hybrid Trials conducted in Ntui and Mayo Galke showed significant correlations between yield and stand. This was because the hybrids had good germination due to new seeds coming from IITA. On the other hand, the two check varieties had poor germination because we do not have a good seed storage facility in Yaounde. Therefore, we re-analyzed the data from the above two locations and the summary yields in the three locations in 1985 are shown in Table 18. Significant differences were obtained only in Sanguere with hybrids 8428-19, 8321-18, 8321-21 and 8322-13 significantly yielding better than Gusau TZB-81. Both 1985 and 1986 data, however, showed that the hybrids had better stand establishment than the open-pollinated check varieties.

The 1985-86 results of the International White Hybrid trials showed that using current field practices there was no convincing evidence that the hybrids yielded better than our best check (Gusau TZB-81 or Gusau TZB-SR). The best performing white hybrids are 8429-19 and 8321-18. Since these two hybrids are single crosses which are hard to manage because they are genetically less buffered and seed production is more expensive than other types of hybrids, the prospects of their commercial use in Cameroon is very minimal unless a package of agronomic practices can be developed to exploit their genetic potential. In other developing countries, hybrids have to have at least a 25% statistically significant yield advantage in order to be commercially viable.

3.0 POPULATION IMPROVEMENT

Population improvement using intra-population breeding methods is a regular feature of our breeding program. Mass selection is being used to improve local adaptability of high yielding introductions. The above selection scheme is also used in developing varieties tolerant to drought and shading.

3.1 Development of Gene Pools.

In 1984, a late streak resistant gene pool named NCRE 8401 was formed and tested in 1985. Because of its good performance, it was further improved using the S_1 testing scheme. During the first season of 1986, 278 S_1 progenies were brought to IITA in

Ibadan for streak screening. Resistant S_1's were further selfed to produce S_2 progenies which were later advanced to S_3. During the second season of 1986 the same S_1 progenies were yield-tested in Nkolbisson and Ntui. The top 15% that were streak resistant were random mated to produce NCRE 8401 C_1 population.

In 1985, varietal crosses of outstanding local varieties and introductions were made. The crosses were grouped into early, intermediate, and late maturity groups and yield tested in 1986. The objective of the test is to determine the heterotic relationships of the varieties so that they can be grouped together for use in a reciprocal recurrent selection program.

3.2 Development of Drought Tolerant Varieties.

Drought or moisture stress is the most important agronomic problem in the savannah areas of Cameroon. Reduction in yield is due to the following occurrences of moisture stress relative to the stage of growth :

a) Stress occurring immediately after planting.

b) Moisture stress prior to silking usually in the month of July.

c) Stress during silking and pollination which usually falls in the month of August.

d) Moisture deficits during grain filling.

The drought problem in the Sudan and South Sahel savannahs of Cameroon is accentuated by the long crop cycle of present varieties. The ideal cropping season and the crop cycle of the present savannah varieties are as follows :

Z O N E		CROPPING SEASON	DAYS	CROP CYCLE OF PRESENT VARIETIES
South Sahel Savannah	(SSS)	01/7 to 15/09	77	105
Sudan "	(SS)	26/6 to 20/09	87	105
North Guinea "	(NGS)	10/6 to 30/09	112	120

Ideally the crop cycle for the three zones is 80 days or less for the SSS, 90 days or less for the SS and 110 days for the North Guinea Savannah. This is because there is a high frequency of moisture stress towards the end of the season (Table 19). It is obvious from the presentation above that development of early maturing varieties will greatly minimize yield reduction due to drought. This is the reason why we are recommending CMS 8501 C_1 instead of MEX. 17E in the South Sahel and Sudan savannahs.

The relationship of maize yield and rainfall during 1983 to 85 in the Sudan and North Guinea savannahs of Cameroon were studied using the step wise regression technique. The independent variables used were total and long term average rainfall; precipitation during the actual growing season; July and July plus August rainfall, number of rainy days and elevation. Results of the analysis are shown in Table 20. In 1983 where rainfall is least but well distributed, total rainfall determined 80% of yield variability while July and August rainfall combined was responsible for another 19%. During the 1984 season rainfall was more than 1983 but there was a long drought during August which fell during pollination and grain filling. In that year, number of rainy days determined 67% of yield variability while August rainfall was responsible for the other 31%. Yield in 1984 was 2 to 4 tons less than in 1983 in spite of a larger total rainfall. In 1985, rainfall was much better than both 1983 and 1984. July rainfall and number of rainy days were responsible for 41 and 58 percent, respectively of yield variability in the Sudan and North Guinea savannahs (Table 20). The combined 1983 to 1985 data show that July and July plus August rainfall were responsible for 49% of yield variability. Average rainfall accounted only for 12% of yield variability. These data show that moisture stress during July and August are the most important of the stresses defined earlier, and breeding and agronomic strategies for drought tolerance should be directed towards the alleviation of moisture stress during these months. The data also points out the inadequacy of total and average rainfall and number of rainy days as precipitation parameters to be used as guide in breeding and agronomic studies concerning moisture stress.

3.21 Selection strategies for drought tolerance.

Aside from developing early maturing varieties for evading drought, we also try to improve the rooting ability of the CMS populations by mass selecting progressively in increasing densities. The populations and density at each cycle of selection were as follows :

	POPULATION	CYCLE 1	CYCLE 2	CYCLE 3
1.	CMS 8501 C_1	82 TPPH	111 TPPH	111 TPPH
2.	CMS 8503 C_1	82 "	-	-
3.	CMS 8507 C_1	82 "	-	-

(TPPH = Thousand plants per hectare).

The idea is that by increasing competition, the plants are induced to root vigorously to compete. Simultaneously, the populations were moved to silk earlier by removing the tassels of plants that have not silked on their silking date as indicated in section 2.4. During cycle 1 ears were selected from all plants of CMS 8501 C_1, and CMS 8503 C_1. In cycles 2 and 3 of CMS 8501

C_1, selections were only made on non-detasseled plants. For CMS 8507 C_1, only second ears were harvested from bordered plants. Plants without second ears were discarded. The selection procedure will be continued until the two other populations reach cycle 3 and all three will be tested to monitor genetic advance.

3.3 Development of varieties suited for intercropping.

About 95 percent of the maize crop in the lowland forest zone is grown in association with other crops. In terms of competition for nutrients, water and light, maize can be either the dominant (DC) or non-dominant competitor (NDC). In a mixture where maize is the less valued crop, early maturing maize is desired so that it will not cause too much reduction in yield of the intercrop. Thus breeding for short cycle maize is one strategy that we are using to develop varieties for intercropping. This portion of the work was already reported in section 3.21.

In the East Province, maize is eaten by roasting from 30 to about 50 days after silking. Consequently, farmers prefer maize with floury endosperm that are soft even when roasted at a later date. This portion of the work involves the improvement of BSR 81 a low yielding floury variety by crossing it to CMS 8503 C_1. In 1986, the F_2 population was produced and ear-to-row selection will be made in 1987.

In cropping systems where maize is a NDC such as when it is planted under plantains, it is important that the variety is not too sensitive to shading so that it does not go barren. What we desire is to develop shade tolerant varieties and for this purpose we used CMS 8507 C_1 as base population. Mass selection is being used and the selected individuals were picked by harvesting the second ears of competitive plants planted at 70cm x 35cm with two plants per hill or a field stand of 82 thousand plants per hectare at harvest. In 1986, the first cycle of selection was made. This will be repeated in 1987.

able 1 : Amount of rainfall (mm) and number of rainy days in the lowland savannah test sites in 1985 and 1986.

ONE/LOCATION	RAINFALL				No. OF RAINY DAYS		
	Long Term Average (Yrs)	Five Year Average (82-86)	1985	1986	Five Year Average (82-86)	1985	1986
OUTH SAHEL							
1. Guetale	847 (35)	717	802	635	57	66	53
2. Maroua	775 (41)		622	784		51	59
3. Guidiguis	720 (17)						
MEAN	781						
JDAN							
4. Soucoundou	994 (15)	902	804	938	62	62	69
5. Sanguere	925 (16)	855	864	892	59	65	66
6. Bere	873 (5)	873	946	1018	56	74	61
MEAN	931	877	871	949	59	67	65
ORTH GUINEA							
7. Fignole	1161 (23)	1059	1289	1093	67	73	63
8. Tchollire	1299 (33)	984	1116	1184	92	82	78
9. Touboro	1237 (22)	1161	1599	1030	77	91	92
MEAN	1232	1068	1324	1102	79	87	78

Table 2 : Yields (T/Ha) of entries in the 1986 NVT (I/L group) planted in three forest locations.

	E N T R Y	BERTOUA	NTUI +	NJOMBE +	MEAN
1.	Gusau TZB 81 (ck)	6.5	5.9	8.7 a	7.0
2.	EV. 8443-SR	5.9	7.4 a	7.3 b	6.9
3.	PR. 7822-SR	5.8	6.8 a	7.9 ab	6.8
4.	CMS 8507 C_1	6.0	7.5 a	7.5 b	6.7
5.	CMS 8503 C_1	5.5	6.4 a	7.3 b	6.4
6.	Suakoko TZPB-81	6.4	6.2	6.7	6.4
7.	EV. 8328-SR	5.3	6.2	7.2 b	6.2
8.	CMS 8505 C_1	4.6	6.2	7.4 b	6.1
9.	Ekona White	5.7	4.9	7.0 b	5.9
10.	CMS 8509 C_1	5.2	5.6	7.0 b	5.9
	MEAN	5.7	6.2	7.4	6.3
	LSD (.05)	-	1.1	1.1	
	C.V. (%)	16	13	11	

±/ Values followed by the same letter(s) are not different at the 5% level of probability.

Table 3 : Yields (T/ha) of entries in the 1986 NVT (I/L group) planted in four savannah locations.

ENTRY	MAYO GALKE+	FIGNOLE+	SOUCOUN-DOU+	SANGUERE+	MEAN
1. CMS 8507 C_1	7.4 a	6.3 b	5.4 a	6.7 a	6.45
2. Suakoko TZPB-81	7.1 a	7.0 ab	5.3 a	5.4 a	6.20
3. EV. 8443 SR	6.7 a	6.4 b	4.9 a	6.7 a	6.18
4. PR. 7822-SR	6.9 a	7.6 ab	4.4	5.3 a	6.05
5. CMS 8503 C_1	6.6 a	6.3 b	5.3 a	5.5 a	5.92
6. EV. 8328 SR	6.5 a	6.1 b	4.9 a	5.7 a	5.80
7. Gusau TZB-81	5.6	6.8 ab	4.7 a	5.5 a	5.65
8. CMS 8509 C_1	5.8	6.7 ab	4.2	5.5 a	5.55
9. TZPB K81 (CK)	6.4 a	6.7 ab	4.0	4.4	5.38
10. CMS 8505 C_1	5.5	6.0 b	3.9	3.9	4.82
MEAN	6.4	6.8 b	4.7	5.5	5.80
LSD (.05)	1.3	1.1	0.7	1.6	
C.V. (%)	15	13	11	20	

±/ Values followed by the same letters are not different at the 5% level of probability.

Table 4: Yields (T/Ha) of entries in the 1986 NVT Early group.

ENTRY	NTUI, Sn-1[+]	MAROUA	MAKEBI[+]	NTUI, Sn-2	MEAN
1. EV. 8431 SR BC_4	4.2 a	5.3	5.1 b	4.1	4.7
2. CMS 8501 C_1	3.8 a	-	6.7	3.4	4.6
3. EV. 8449 SR BC_2	3.8 a	5.2	5.5 b	3.9	4.6
4. CMS 8503 C_1	4.0 a	6.0	4.1	3.5	4.4
5. IK. TZESR-W	3.7 a	5.1	4.9 b	3.9	4.4
6. EV. 8435 SR BC_4	3.8 a	5.7	4.1	3.9	4.4
7. SAFITA 2	3.4 a	5.4	4.6 b	3.6	4.2
8. CHECK ++	3.0	4.9	4.6 b	3.4	
MEAN	3.7	5.4	4.9	3.7	4.4
LSD (.05)	1.1	-	1.0	-	
C.V. (%)	22	23	14	17	

±/ Values followed by the same letters are not significant at the 5% level of probability.

±/ Mexican 17E in the savannah zones and BSR 81 in forest zones.

Table 5 : Yield and other agronomic characteristics of entries in the 1986 EEVT (I/L) planted in Fignole from 18 June to 17 October, 1986.

ENTRY	YIELD* (T/HA)	PROLI-FICACY	EAR WEIGHT (gm)	YIELD PER PLANT (%)	MOISTURE (%)	EAR HEIGHT (cm)	PLANT HEIGHT (cm)
1. FR. 8464	7.4 !	1.02	215	126	29.4	86	178
2. NCRE 8401	7.4 !	1.08	272	161	31.2	102	203
3. SYN A	7.1 !	1.05	320	139	23.9	108	201
4. CMS 8507 C_1	7.0 !	1.10	255	157	28.7	81	192
5. ACROSS 8464	6.8 !	1.05	207	124	19.4	91	191
6. SYN 3	6.6 !	1.05	228	131	31.6	92	190
7. SYN 4	6.2 !	1.02	254	146	30.6	104	209
8. EV. 8340 SR BC_4	5.9 !	1.02	198	112	27.9	67	178
9. SUWAN 8464	5.8 !	0.93	214	113	28.3	87	187
10. CMS 8505 C_1	5.5	1.05	265	151	31.2	92	206
11. ESR 81	4.7	.95	193	114	22.6	103	208
12. POPULATION 49	4.5	1.00	179	101	29.5	79	177
MEAN	6.2	1.03	225	132	28.7	93	193
LSD (5%)	1.8	-	29.5	27.1	5.8	20.5	26.3
C.V. (%)	19.7	12.3	9.1	14.3	14.1	15.4	9.4

*/ Values within the bar are not different at the 5% level of probability.

Table 6 : Yields (T/Ha) of entries in the RUVT-1 trials planted in Maroua and Sanguere in 1986.

ENTRY	SANGUERE[a]	MAROUA
1. EV. 8431-SR	5.7 !	5.5
2. SAFITA 2 RE	5.6 !	4.5
3. M.G. 62 TZESR-W	5.4 !	5.3
4. CMS 8503 C_1	5.4 !	4.5
5. POP. 30-SR EARLY	5.3 !	4.8
6. C.S.P.	4.8	5.7
7. J.D. DE BAMBEY	4.7	5.4
8. SIDS 8245	4.7	5
9. D. 822	4.6	5.6
10. CANINOPOLIS 8245	4.6	5.7
11. EARLY 84 TZESR-W	4.3	4.8
12. D. 765	3.6	4.9
MEAN	4.9	5.2
LSD (5%)	0.8	-
C.V. (%)	11	22

a/ Entries within the bar are not significant at the 5% level of probability.

Table 7 : Yield and other agronomic characteristics of entries in the RUVT-2 trial of SAFGRAD planted in Fignole from 18 June to 17 October, 1986.

ENTRY	YIELD[+] (T/HA)	EAR WEIGHT (gm)	YIELD PER PLANT (gm)	MOISTURE (%)	HEIGHT EAR (cm)	HEIGHT PLANT (cm)
1. EV. 8422-SR	8.9	261	146	30.4	94	196
2. CMS 8507 C_1	7.6	249	151	24.4	93	202
3. ACROSS 83 TZUT-W	7.5	232	141	23.8	102	216
4. STAHA	7.5	227	132	27.6	106	209
5. EV. 8443-SR	7.4	245	128	24.4	104	216
6. EV. 8449-SR	7.4	190	116	24.2	78	176
7. SAFITA 102 FE	6.9	230	130	29.2	102	194
8. KAMB (2) 83 TZUT-W	6.7	234	138	26.0	86	196
9. ILONGA 8032	6.2	206	118	28.0	72	164
10. EV. 8435-SR	4.7	150	96	20.6	69	172
11. LATENTE x LATENTE	3.8	119	77	19.8	68	144
MEAN	6.8	213	125	26.2	88	189
LSD (5%)	1.3	23	16	3.7	23	28
C.V. (%)	13.3	7.6	8.8	9.8	18.2	10.1

+/ Varieties under the bar are not statistically different at 5% probability level.

Table 8 : Yields (T/Ha) of entries in the RUVT-3 trials planted in Sanguere and Maroua in 1986.

	ENTRY	SANGUERE++	MAROUA++	MEAN
1.	CHECK+	5.2 a	5.6 a	5.4
2.	POP. C.S.P.	4.9 a	5.7 a	5.3
3.	KITO	4.8 a	5.7 a	5.2
4.	POP 31-SR EARLY	4.3 a	5.6 a	5.0
5.	COMPOSITE D	3.8 a	6.1 a	5.0
6.	SAFITA 104 RE	3.8 a	5.2 a	4.5
7.	KAICHAN JAUNE	3.9 a	4.7	4.3
8.	LOCAL RAYTIRI	2.8 a	5.0 a	3.9
9.	LOCAL KOUDOUGOU	2.7 a	4.5	3.6
10.	C.J.P. 75	2.4	3.9	3.2
11.	(GUA 314 x VEN 389) F3	2.2	3.4	2.8
12.	KAMANDAOGO TOLLO	1.9	3.2	2.6
	MEAN	3.5	4.9	
	LSD (5%)	0.6	1.2	
	C.V. (%)	12	15	

+/ Sanguere = CMS 8501 E1; Maroua = CMS 8503 C1

++/ Values followed by the letter "a" are not significantly different at the 5% level of probability.

Table 8a : Yield and other agronomic characteristics of entries in the RUVT-3 trial of SAFGRAD planted in Sanguere from 26 June to 29 September, 1986.

	ENTRY	YIELD+ (T/HA)	PROLI-FICACY	EAR WEIGHT (gm)	YIELD PER PLANT (gm)	MOISTURE (%)	DAYS TO SILK	HEIGHT (cm)	
								EAR	PLANT
1.	CMS 8501 E1	5.2 !	1.17	156	94	35	39	55	139
2.	POP C.S.P.	4.9 !	0.99	131	71	31	37	49	128
3.	KITO	4.8 !	1.00	135	60	34	39	58	145
4.	POP 31 SR EARLY	4.3	0.98	153	75	37	40	55	146
5.	KAICHAN JAUNE	3.9	1.08	97	60	28	36	44	134
6.	SAFITA 104 RE	3.8	1.11	108	67	31	37	48	140
7.	COMPOSITE D	3.8	1.00	110	64	27	37	60	150
8.	LOCAL KAYTIRI	2.8	1.11	88	56	30	38	61	156
9.	LOCAL KOUDOUGOU	2.7	1.04	70	44	24	34	40	141
10.	C.J.P. 75	2.4	1.03	68	39	30	36	54	150
11.	(GUA 314 x VEN 389) F3	2.2	1.30	52	40	26	36	55	141
12.	KAMANDAGGO TOLLO	1.9	1.12	45	33	18	26	36	124
	MEAN	3.5	1.08	101	59	29	36	51	141
	LSD (5%)	0.6	-	18	16	6	3	-	18
	C.V. (%)	12.4	13.0	12.2	19.5	13.2	5.0	22.3	8.6

+/ Values within the bar are not significant at the 5% level of probability.

Table 8b : Yield and other agronomic characteristics of entries in the RUVT-3 trial of SAFGRAD planted in Maroua from 27 June to 27 September, 1986.

ENTRY	YIELD[+] (T/HA)	PROLI-FICACY	EAR WEIGHT (gm)	YIELD PER PLANT (gm)	MOISTURE (%)	DAYS TO SILK	HEIGHT (cm) EAR	HEIGHT (cm) PLANT
1. COMPOSITE D	6.1 !	1.04	156	97	25	39	97	217
2. KITO	5.7 !	1.04	154	85	34	41	88	206
3. POP. C.S.P.	5.7 !	0.97	163	88	31	38	77	197
4. CMS 8503 C_1	5.6 !	1.03	231	89	53	52	122	249
5. POP 31-SR EARLY	5.5 !	1.01	183	92	38	40	81	205
6. SAFITA 104 RE	5.2 !	0.99	157	81	35	39	87	206
7. LOCAL RAYTIRI	5.0 !	1.03	143	86	25	39	86	220
8. KAICHAN JAUNE	4.7	1.03	131	73	32	38	81	205
9. LOCAL KOUDOUGOU	4.5	1.03	125	74	28	37	92	179
10. C.J.P. 75	3.9	1.11	112	73	27	37	78	199
11. (GUA 314 x VEN 38[illegible]) F3	3.4	1.16	77	56	22	36	69	187
12. KAMANDAOGO TOLLO	3.2	1.01	87	55	21	32	48	154
MEAN	4.9	1.04	143	79	31	39	84	202
LSD (5%)	1.2	-	24	17	3	2	17	30
C.V. (%)	15.0	6.11	10.0	12.0	6.1	2.3	11.8	8.8

+/ Values within the bar are not significant at the 5% level of probability.

Table 9 : Yields (T/Ha) of entries in the EVT-ESR-W planted in Sanguere and Soucoundou in 1986.

	ENTRY	SANGUERE	SOUCOUNDOU	MEAN
1.	M.G. 82 TZESR-W	4.9	5.0	5.0
2.	CMS 8503 C_1	4.3	4.4	4.4
3.	K. 84 TZESR-W	4.6	4.6	4.2
4.	EV. 8430-SR RSF	4.3	4.3	4.0
5.	GUSAU 81 POOL 16 RF	4.0	4.0	4.0
6.	K. 84 POOL 16	4.5	4.5	3.9
7.	IKENNE-84 POOL 16	3.6	3.6	3.9
8.	IK. (2)-84 TZESR-W	4.4	4.4	3.7
9.	SAMARU 84 TZESR-W	3.9	3.9	3.7
10.	MEX. 17E	3.7	3.7	3.7
11.	BERTOUA-84 TZESR-W	4.3	4.3	3.6
12.	ACROSS 84 TZESR-W	3.6	3.6	3.5
13.	GUSAU 84 POOL 16	4.0	4.0	3.4
14.	DMR-ESR-W	3.2	3.2	3.2
	MEAN	4.1	3.7	
	LSD (.05)	-	-	
	C.V. (%)	18.8	37.8	

Table 11 : Yield and other agronomic characteristics of EVT-LSR-WHITE entries planted in Karewa in 1986.

ENTRY	YIELD+ (T/HA)	PROLI-FICACY	EAR WEIGHT (gm)	YIELD PER PLANT (gm)	MOISTURE (%)	DAYS TO SILK	PLANT HEIGHT (cm)
1. EV. 8443 SR BC_4	6.5	.98	194	124	20	50	293
2. SAMARU 83 TZR-W-1	6.5	1.02	199	132	19	51	298
3. EV. 8429-SR BC_4	6.3	.93	198	118	20	50	276
4. CMS 8507 C_1	6.0	1.10	194	137	18	52	287
5. TZB GUSAU RE	5.9	1.00	176	116	20	50	298
6. EV. 8422-SR BC_4	5.9	.98	194	119	19	52	291
7. IKENNE 83 TZSR-W-1	5.7	.93	188	112	22	50	292
8. SEKOU 81 TZSR-W-1	5.7	1.10	150	110	15	51	295
9. ACROSS 83 TZSR-W-1	5.5	1.02	170	112	18	50	298
10. EV. 8443 SR BC_4 RFS	5.2	.98	172	110	17	52	292
11. EKONA 83 TZSR-W-1	5.0	.88	162	94	17	52	296
12. SUAKOKO TZPB K81	4.8	.98	222	137	19	50	285
MEAN	5.8	.99	185	118	19	51	292
LSD (.05)	-	-	34	-	2	-	-
C.V. (%)	15.3	14.1	12.6	17.3	5.7	2.6	6.0

Table 12 : Yields of entries in the EVT-LSR-Y planted in Bertoua in 1986.

ENTRY	YIELD+ (T/HA)	PROLI- FICACY	EAR WT. (gm)	YIELD PER PLANT	MOIS- TURE (%)	DAYS TO SILK	EAR HEIGHT (cm)	PLANT HT. (cm)	No. OF PLANTS LODGING	No. OF BROKEN PLANTS
1. EKONA 83 TZSR-Y-1	4.9 !	1.07	192	139	16.8	56	115	205	6	6
1. IK. 83 TZSR-Y-1	4.9 !	1.02	204	138	17.5	62	110	220	3	4
3. SAM. 83 TZSR-Y-1	4.7 !	0.80	177	97	14.2	58	115	228	6	5
4. FERKE 81 TZSR-Y-1	4.6 !	0.90	183	110	17.2	57	134	235	11	6
5. IK. 81 TZSR-Y-1	4.3 !	1.02	184	130	14.8	55	122	214	10	4
6. FERKE (i) 2126	4.2 !	1.02	176	118	17.7	55	104	211	9	4
6. ACR. 83 TZSR-Y-1	4.2 !	9.95	182	115	17.0	60	105	195	5	5
8. EV. 8428-SR BC_4	3.8 !	0.97	186	119	15.7	54	100	208	8	6
9. KAM. 83 TZSR-Y-1	3.6 !	0.96	180	116	16.4	60	110	200	3	4
10. CK. 2 (BSR 81)	3.0 !	0.88	141	83	15.6	55	115	241	13	7
11. CK. 1 (LOCAL KOUNDI)	1.1	0.60	94	37	17.8	62	138	272	11	5
MEAN	3.9	0.92	173	109	16.4	58	115	221	8	5
LSD (.05)	1.5	0.26	28	36	-	2	-	36	-	-
C.V. (%)	26	19	11	23	12	3	15	11	-	-

Table 13 : Yields (T/Ha) of entries in the EVT. 15A - D4 planted in Bertoua and Mayo Galke in 1986.

	ENTRY	BERTOUA	MAYO GALKE+	MEAN
1.	POZA RICA 8362	3.9	4.0 a	4.0
2.	GUSAU TZBSR	3.0	4.5 a	3.8
3.	SUWAN 8363	2.7	4.7 a	3.7
4.	POZA RICE 8362	2.8	4.4 a	3.6
5.	EL VALLEC 8365	2.9	4.3 a	3.6
6.	SAN JERONI. 8363	3.1	4.1 a	3.6
7.	LAS ACAC (1) 8363	2.8	4.1 a	3.4
8.	ACROSS 8363	3.7	3.0 a	3.4
9.	LOS BANOS 8362	3.5	3.1 a	3.3
10.	SAN JERO (1) 8263	3.4	3.0 a	3.2
11.	ACROSS 8365	2.6	3.4 a	3.0
12.	ALAJUELA 8363	2.8	3.2 a	3.0
13.	LA MOLINA 8365	2.6	3.2 a	2.9
14.	PALMIRA 8365	3.0	2.8	2.9
15.	GUARARE 8365	2.0	3.4 a	2.7
16.	PALMIRA 8362	2.8	2.6	2.7
17.	ACROSS 7940 RE	2.5	2.8	2.7
18.	LA MAQUINA 8363	1.6	3.5 a	2.6
19.	POZA RICA 8365	2.2	3.0 a	2.6
20.	BSR 81	2.3	2.6	2.4
21.	LA MAQ. (1) 8363	2.4	2.4	2.4
22.	ACROSS 7726 NRE	2.1	2.5	2.3
	MEAN	2.8	3.4	3.1
	LSD (.05)	-	1.8	
	C.V. (%)	3.4	3.8	

±/ Figures followed by the letter "a" are not significant at the 5% level of probability.

COMP.PERFORMANCE.CMS8507 & GUZAU TZB81

(7 LOCATIONS – 1986)

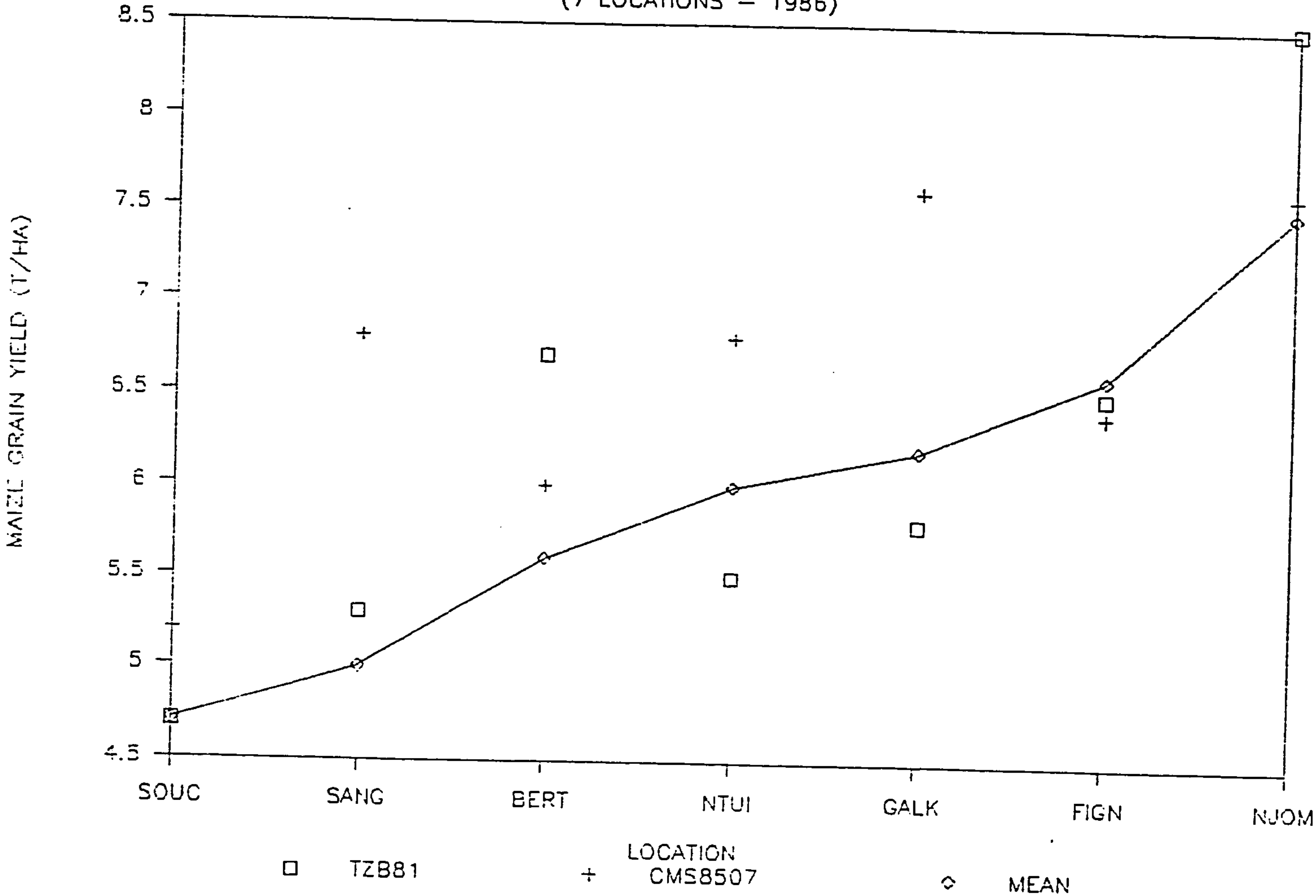

Table 14 : Summary table of the yields (T/Ha) of entries in the advanced yield tests in the savannah zones of Cameroon in 1986.

	E N T R Y	SANGUERE++	KAREWA I	KAREWA II	MEAN
1.	CMS 8507 C_1	7.5	4.8	5.2	5.8
2.	CMS 8505 C_1	5.2 a	3.8	5.0	4.7
3.	NCRE 8401	6.1 a	-	-	-
4.	CMS 8509 C_1	6.2 a	5.2	-	5.7
5.	CMS 8503 C_1	-	4.6	-	-
6.	SUAKOKO TZPB-81	-	-	5.5	-
7.	TZPB-K81	-	-	5.1	-
	MEAN	6.2	4.6	5.2	
	L.S.D.	1.0+	-	-	
	C.V. (%)	7.4	17.8	11.3	

+/ t (.10)

++/ Values followed by the same letter are not statistically significant at the 5% level of probability.

Table 15 : Summary table of the yields (T/Ha) of entries in the advanced yield tests conducted in the forest zone of Cameroon in 1986.

ENTRY	NGOUMOU++	MBANDJOK	MEAN
1. Suwan 1	4.6	5.4	5.0
2. CMS 8503 C_1	5.4 a	5.4	5.4
3. SUAKOKO TZPB-81	5.9 a	4.9	5.4
4. GUSAU TZB-81	5.6 a	5.5	5.6
5. IMPROVED EKONA WHITE	7.2 a	5.3	6.2
MEAN	5.7	5.3	
L.S.D. (.10)	1.9+	-	
C.V. (%)	15.7	15.3	
% OM	2.97		
AVAILABLE P (ppm)	2.29	50.9	
PH	4.6	4.9	
FERTILIZER APPLICATION	100-80-60	140-60-60	

+/ t (.10)

++/ Values followed by the same letter are not statistically significant at the 5% level of probability.

Table 16 : Comparative yields of CMS 8501 C_1 and Mex. 17E in five trials in 1985 and 1986.

V A R I E T Y	CROP CYCLE (DAYS)	1985 TRIALS			1986 TRIA	
		TOUBORO	SANGUERE	NTUI (2nd season)	NTUI (1st season)	MA
CMS 8501 C_1	90	4.9	5.4	3.8	3.8	6
MEX. 17E	105	4.5	5.0	1.2	3.0	4
MEAN DIFFERENCE		0.4=	0.4=	2.6*	0.8=	2

*/ Significant at the 5% level of probability

=/ Not significant.

Table 17 : Yields (T/Ha) of entries in the International White Hybrid Trial planted in three locations in 1986.

ENTRY	KAREWA[+]	MAYO GALKE	NTUI, Sn-2	MEAN
1. 8428-19	6.8 a	6.3	4.3	5.8
2. 8321-18	6.8 a	7.7	4.2	6.2
3. GUSAU TZB-SR	6.4 a	5.4	4.5	5.4
4. 8505-3	6.3 a	5.7	4.2	5.4
5. 8321-21	6.3 a	5.8	4.0	5.4
6. 8322-13	6.1 a	5.4	5.1	5.5
7. TZB SR x NCRE 8401	6.0 a	6.2	4.2	5.5
8. 8505-1	5.8 a	6.9	4.2	5.6
9. SAM. 83 TZSR-W1	5.5	6.0	3.9	5.1
10. 9505-5	4.8	5.9	4.0	4.9
MEAN	6.1	6.2	4.2	5.5
LSD (.05)	1.1	-	-	-
C.V. (%)	13	32	15	

+/ Means followed by the same letter are not significant at the 5% level of probability.

Table 18 : Mean yields (T/Ha) of seven white maize hybrids and three checks grown in three locations in 1985.

	HYBRID	NTUI[c]	MAYO GALKE[c]	SANGUERE[d]
1.	8428-19	6.5 !	7.4 !	7.0 a
2.	8321-18	6.4 !	7.2 !	6.8 ab
3.	8338-1	5.7 !	6.6 !	5.5 b
4.	GUSAU TZB 81[a]	5.4 !	6.3 !	5.6 b
5.	8321-21	5.2	7.3 !	6.1 ab
6.	8326-18	5.1	6.8 !	4.9
7.	8323-11	5.0	7.3 !	4.7
8.	8322-13	4.7	6.9 !	5.8 ab
9.	EV. 8443-SR[b]	4.7	6.6 !	5.6 b
10.	SUAKOKO TZPB 81	4.7	5.0	5.6 b
	MEAN	5.3	6.7	5.8
	LSD (.05)	1.2	1.3	1.3
	C.V. (%)	15.0	13.0	16.0

a/ Forest zone check

b/ Savannah zone check

c/ Values under the bar are not statistically different at 95% level of P.

d/ Values followed by the same letter are not statistically different at 95% level of P.

Table 19 : Relative frequency (%) of moisture stress in July and August in some savannah sites.

LOCATION / ZONE		RAINFALL JULY <40 mm	RAINFALL AUGUST <60 mm
Maroua (SSS)	10	39	46
	20	37	27
	31	12	24
Sanguere (SS)	10	19	38
	20	38	31
	31	38	38
Tchollire (NGS)	10	15	30
	20	18	36
	31	6	2

Table 20 : Important determiners of maize yield in the savannah zones of Cameroon.

YEAR	INDEPENDENT VARIABLE	COEFFICIENT OF DETERMINATION ON YIELD (%)
1983	Total rainfall	80
	July and August rainfall	19
	T O T A L	99
1984	No. of rainy days	67
	August rainfall	31
	T O T A L	98
1985	July rainfall	41
	No. of rainy days	58
	T O T A L	99
1983 to 1985	July rainfall	20
	July and August rainfall	29
	Average rainfall	12
	T O T A L	61

V. WORK PLAN, LOWLAND MAIZE BREEDING

OAL : To increase maize production in Cameroon through the identification and development of suitable maize varieties for lowland areas.

SUB-GOAL	METHODS	INPUTS REQUIRED	INPUTS BEYOND CONTROL	OUTPUT	% OF TIME
MAIZE BREEDING					
ort-term					
Production of breeder and foundation seeds of recommended varieties.	1.1 Isolation in time and space. 1.2 Rouging of diseased and off-types.	1.1.1 Off-season growing areas w/ irrigation system. 1.1.2 Seed processing area and equipment. 1.1.3 Seed storage facilities. 1.1.4 Pesticides and pollinating supplies. 1.1.5 Field transport facilities.	1.1.1.1 Weather 1.1.1.2 Availability of equipment. 1.1.1.3 Availability of supplies and materials. 1.1.1.4 Additional researcher.	Availability of breeder seed and foundation seed.	15
Development of superior streak resistant varieties.	2.1 Introduction of SR germplasm from IITA, CIMMYT, SAFGRAD and other breeding centers. 2.2 3-tiered testing in various zones, locations and years. 2.3 Evaluation for pest and disease resistance. 2.4 Population improvement for yield on selected varieties.	2.1.1 Same as 1.1.1 through 1.1.1.5. 2.1.2 IBM PC 2.1.3 Field equipment (moisture testers, scales, etc.).	2.1.1.1 Same as 1.1.1.1 thru. 1.1.1.4. 2.1.1.2 Researcher in the N. Province and technician in SW Prov. (Njombe). 2.1.1.3 Availability of vehicle in N. Prov. 2.1.1.4 Availability of pathologist and entomologist. 2.1.1.5 Laboratory for culture and multiplication of inoculates.		14

Long-term

3. Development of two additional gene pools for use in long-term breeding.	3.1 Three-tiered testing as in 2.2. 3.2 Evaluation for pest and disease resistance. 3.3 Determination of heterotic patterns. 3.4 Intra-population improvement.	3.1.1 Same as 2.1.1 through 2.1.3.	3.1.1.1 Same as 2.1.1.1 through 2.1.1.5.	Identification of parental varieties.	6
4. Population improvement for agronomic characteristics of identified superior populations.	4.1 Intra-population improvement. 4.2 Testing of improved populations. 4.3 Evaluation for pest and disease resistance.	4.1.1 Same as 3.1.1.	4.1.1.1 Same as 3.1.1.1.	One cycle improvement of CMS 8051, 8503, 8507 and 8509.	10
. Development of varieties tolerant to drought.	5.1 Intra-population improvement under high density stress. 5.2 Evaluation under artificially induced water stress.	5.1.1 Same as 3.1.1.1.	5.1.1.1 Same as 3.1.1.1.	Drought resistant varieties available.	10
. Development of early maturing varieties.	6.1 Intra-population selection for earliness. 6.2 Evaluation for pest and disease resistance. 6.3 Three-tiered evaluation of selections. 6.4 Variety testing in commercial field.	6.1.1 Same as 3.1.1.	6.1.1.1 Same as 3.1.1.1.	One cycle improvement for CMS 8501, 8503 and 8507.	14

7. Development of varieties for use in intercropping in the lowland forest zone.	7.1 Intra-population selection for multiple eared-ness. 7.2 Evaluation for pest and diseases resistance. 7.3 Three-tiered evaluation of selections. 7.4 Variety testing in farmers' fields.	7.1.1 Same as 3.1.1.	7.1.1.1 Same as 3.1.1.1.	One cycle mass selection for prolificacy in CHS 8507.	4.5
. Assist in line development for production of synthetic population and/or hybrid development.	8.1 Extraction of S1. 8.2 Advancement to S2 and crossing. 8.3 Advancement of selected S2 to S5. 8.4 Diallele test of selected S5. 8.5 Production of hybrids. 8.6 Testing of hybrids.	8.1.1 Same as 2.1.1 and 2.1.3.	8.1.1.1 Same as 3.1.1.1.	None	2
. Assist in the introduction of specialized maize types such as sweet, waxy and high protein maize.	9.1 Introduction of varieties from other breeding programs. 9.2 Evaluation for pest and disease resistance. 9.3 Intra-population improvement if performance is not good or transfer of desired trait to locally adapted varieties. 9.4 Three-tiered yield test.	9.1.1 Same as 3.1.1.	9.1.1.1 Same as 2.1.1.1 and 2.1.1.3 thru 2.1.1.4. 9.1.1.2 Cooperation of farmers.	None	2

	9.5 Testing in farmers' fields.				
10 Assist in the development of varieties tolerant to low soil pH.	10.1 Evaluation of local and foreign germplasm for tolerance to low soil pH.	10.1.1 Same as 3.1.1.	10.1.1.1 Same as 3.1.1.1.	None	2
	10.2 Intercrossing of selected varieties and random mating of F2.				
	10.3 Intra-population selection within the population.				
	10.4 Evaluation for yield and disease resistance.				
B. G E N E R A L					
1. Institutional development	1.1 On-the-job training.	1.1.1 None	1.1.1.1 None	Improved institutional capacity for research.	5
	1.2 Advising degree-related trainees.				
	1.3 Providing equipment lists and setting it up when it arrives				
	1.4 Establish linkages w/national and international organizations.				
2. Professional Improvement.	See Section III.				4
3. Home leave.					11.5
					100

HIGHLAND MAIZE AGRONOMY

I. THE EFFECT OF RESIDUE MANAGEMENT AND FERTILIZER ON THE PRODUCTIVITY OF A MAIZE-BASED CROPPING SYSTEM

The objective of the present study was to fully characterize the nature of crop response to the various residue management practices over years. It was also the purpose of the study to find ways of replacing the "Ankara" burning residue underground practice with better residue management practices that do not result in soil damage.

METHODOLOGY

The effect of three residue management practices (bury residue, burn it above ground and burn it underground) on a maize based cropping system were compared at various fertilizer levels. The crop combinations were : maize sole; maize and colocasia; and maize, colocasia and beans. The study was carried out at two sites at Bambui Plain, the old site and new site. The trial at the "old site" was in its third year whereas that at the "new site" was in its second year. The main difference between the sites being the number of years of testing and the fact that the new site has one fertilizer level higher than the old site.

RESULTS AND DISCUSSION

There was no significant effect of cropping pattern neither was it involved in any significant interactions in the case of maize yields. The data on maize yields is the mean over all the three cropping patterns in which maize was involved. The yield of colocasia was so much affected by maize where it was intercropped that including the treatment in which it was intercropped would lead to under-estimation of its performance under sole crop. The yields of colocasia presented are those of the sole crop colocasia.

Applying fertilizer resulted in an increase in maize yield at the old site (Table 2). This increase was highest when residue had been buried only, (72%). When no fertilizer was applied burning residue underground resulted in an increase in maize yield of 44.8% compared to when the residue was buried. There was, however, no difference between the two practices when fertilizer was applied. On the average, burning residue underground out-yielded burying it by only about 17%. Applying fertilizer resulted in a significant increase in the yield of colocasia (Table 3). Burying residue resulted in the highest colocasia yield; burning it underground has the lowest. The difference in yield, however, was not significant. This year was the first year when burning residue did not out-yield burying it.

At the new site, burning residue at the soil surface resulted in maize yields significantly greater than when residue was buried (Table 4). The effect of burning it underground, however, was not significantly greater than when it was buried.

Adding fertilizer resulted in increased maize yield at each level. Applying 100-60-60 N-P-K/Ha resulted in a 72% increase in yield over the non-fertilized plot. Doubling this fertilizer level, however, resulted in a further increase of only 14%.

The yield of colocasia at the new site had a similar trend of that of maize, that is, residue management had very little effect (non-significant) on the yield of colocasia and fertilizer application increased yield (Table 3).

When compared with the desired practice of burying residue over years, the yield of maize was very high in the first year of burning (Table 5) especially when no fertilizer was applied. In the period of three years the yields of maize has come down from a high of 332% of the burying residue to only 144%. Similarly, the yield has gone down in plots receiving fertilizers. Burning residue underground did not affect the yield of colocasia as it did of maize. There was, however, a positive response to burning in the first two years.

CONCLUSIONS

The yield trends due to residue management have been sufficiently characterized. Although burning residue underground increases yield in the early years, the yield drops drastically in the later years.

Results indicate that with moderate application of fertilizers, the burning of residue underground can be avoided. The study will in future be directed towards identifying the minerals that are supplied to the soil when residue is burnt underground and supplying them from commercial sources accordingly.

It is assumed that the initial high yields are associated with the rapid mineralization and the concomitant change in soil pH. Future work will concentrate on finding ways of reducing immobilization of minerals and supplying the required minerals through the use of fertilizers while burning is avoided.

2. THE RESIDUAL EFFECT OF LIMING AND PHOSPHORUS APPLICATION ON YIELD OF MAIZE AND THAT OF THE SUCCEEDING LEGUME.

The primary objective of this study was to determine the effect of liming on phosphorus availability and how this is reflected in the yield of maize and that of the dry beans planted assess the economics of such soil treatment by growing crops on the same piece of land to take full advantage of the amendment.

M E T H O D O L O G Y

Lime and phosphorus were applied to the soil in 1984/85 cropping season on land which was previously farmed and in 1985/86 on land previously under fallow both at Bambui Plain. Lime was applied at the rate ranging between 0 and 4 tons/Ha and phosphorus was applied at 50, 100 and 150 kg P_2O_5/Ha in the first year of study. In the case of the old land all the phosphorus was applied as broadcast. At the new land both band and broadcast application were used; the plots which received band application in 1985 were supplied with an additional broadcasted dose during the 1986 growing season.

RESULTS AND DISCUSSION

The effect of residual lime and phosphorus on maize and bean yields are presented in Table 6 and 7. Maize showed response to both residual lime and phosphorus at the old site (Figure 2). Increasing phosphorus increased the yield of maize even when lime was not applied thus implying that phosphorus fixation might not be the problem. Increasing lime levels significantly increased the yield of both maize and beans up to when the level of lime was 2.0 tons/Ha (Table 6). Increasing the level to 4.0 tons/Ha had no significant effect on the crops. Increasing the level of phosphorus to 50 kg P_2O_5/Ha had no effect on yield of the two crops. Applying 100 kg P_2O_5/Ha, however, increased yield over that of 50 kg. Response to increasing phosphorus to 150 kg was not significant.

The low yields at low phosphorus and lime levels were associated with reduced plant stand despite the uniform germination. On the new land, for the second year in a row, there was no effect of lime application on the yield of neither maize nor the beans that followed the maize. The response to phosphorus of maize and beans were quite similar. In both cases the highest yield was obtained when the highest level of phosphorus was applied. At each level an addition of phosphorus resulted in an increase in yield over the same rate applied only in 1985. These increases were significant when phosphorus was applied at 50 kg P_2O_5/Ha in maize and beans and on beans when it was applied at the rate of 150 kg P_2O_5/Ha.

The yields of both maize and beans were higher at the new site where there was limited response than at the old site. This implies that other edaphic factors were more limiting at the former site than the later. That the two crops could respond to low level of lime even when the levels used did not significantly affect the soil pH might suggest that the crops were responding to calcium and magnesium that are present in the dolomitic lime used.

FUTURE STRATEGIES

A good response to moderate levels of lime and phosphorus had been obtained with two of the main crops grown in the area especially where the land has been farmed continuously for some time. There does not seem to be need for liming and phosphorus application where the land has not been continuously farmed. This work should be extended to areas with similar conditions after ascertaining whether the observed response was due to liming per se or the application of calcium or magnesium or both. Also the economics of these application should be considered in light of the fertility of the soil involved and the residual effect of single applications.

3. THE EFFECT OF PLANTING DATE ON MAIZE YIELD

The objective of this study was to determine the response of maize varieties to planting date so as to determine whether the different varieties have different response to planting dates so that recommendations be given accordingly.

M E T H O D O L O G Y

Two varieties of maize were planted at each of three major Bambui Station testing sites, that is Bambui Plain, Babungo and Befang. Maize was planted at weekly intervals for seven weeks. Two improved varieties with as much contrast as possible were used for each site (that is, COCA and BACOA for Bambui Plain, COCA and Kasai I for Babungo and Kasai I and Ekona White for Befang).

RESULTS AND DISCUSSION

Due to the late preparation of the fields, none of the sites was planted before or at March 15. The earliest planted was Bambui Plain (March 20) and the latest planted was Befang (April 18). In general, the yield of maize was reduced the later it was planted (Figure 3). The reduction was greater at Bambui Plain and Befang than at Babungo.

At Bambui Plain the yield of BACOA was increased by 21% by planting on March 27 compared to planting it a week earlier. The yield of COCA was reduced at this site for each week's delay. On the average, delaying planting by 3 weeks decreased yield by 12.8%. A further delay to 4 weeks reduced yield by 44%.

At Babungo, delaying planting of Kasai I from March 23 to April 7, resulted in an increase in yield of 11.1% after which there was a drop in yield.

In the case of COCA, a delay of one week had no effect by further delay resulted in a severe reduction. Kasai I out-yielded COCA at most planting dates.

The maize varieties planted at Befang gave good yields at the first planting date compared to other sites. This yield was even higher when the date of planting is considered (almost one month later). The average reduction in yield on the crop planted May 9 was only 20% of the 6.827 tons obtained by planting at the earliest possible date April 18.

The reduction in yield due to delayed planting was associated with poor stand count at harvest and a reduction in cob size. These seemed to be associated with the incidence of streak (see Bambui Station report 1986/87). The number of days to flowering was also reduced with the late planting, a factor that could have been responsible for the reduction in the size of the cob.

C O N C L U S I O N

The results indicate that for the planting dates used using the three varieties the yield of maize is not greatly reduced if planting is delayed up to April 10 at Bambui Plain, April 14 at Babungo and May 9, in the case of Befang. Beyond these dates streak virus disease and other physiological factors reduce yields greatly. The present study does not give full potential since planting was delaved in relation to the start of the rains (for example, there was a delay of 10 days after the rains had started). It would be beneficial to determine varietal response to dry planting in relation to how they respond to seedling drought should there be a dry spell during early April.

These studies should be carried out every time there is a promising variety that is either different in maturity or streak resistance compared with the existing varieties.

The trial will be continued with more varieties of greater diversity. In future trials, a planting date much earlier than March 15th will be included with a view of avoiding labour conjection at the 'normal' planting time.

4. THE EFFECT OF PLANT POPULATION AND FERTILIZER ON MAIZE YIELD AND THE YIELD OF THE ASSOCIATED GROUNDNUT CROP

The objective of the present study was to determine the effect of plant population of maize on the yield of maize and the associated legume. It was also aimed at determining whether this effect was dependent on the fertility level and variety of maize.

METHODOLOGY

Maize and groundnuts were planted at Babungo trial site on ridges 1.5m wide. Maize was planted on two rows in the centre of the ridge and groundnuts were also planted. Maize was planted at population of 33, 44, 53 and 67 thousand plants and the groundnuts were planted at a plant population of 133,000 plants per hectare. The maize population was obtained by varying intra row population. The two varieties involved were Kasai I and COCA normal. Two fertility levels were used, no fertilizer added and a medium fertilizer.

RESULTS AND DISCUSSION

Fertilizer increased the yield of maize (when averaged over plant population and fertilizer levels) from 3.43 tons per hectare to 5.26 tons/Ha (Table 8). Kasai I significantly outyielded COCA by 14% which was associated with the higher yield of Kasai I when no fertilizer was applied.

Planting maize at 53,333 plants per hectare gave the highest yield (Table 8). This was followed by 44,000 plants and the lowest yield was obtained at the lowest plant population used in the study. The yield difference between the plant populations of 44,000 and 53,000 plants was not significant. This is the trend that has been obtained for the past 3 years.

The yield of groundnut grown with COCA was significantly greater than when it was grown with Kasai I by 14% (Table 9). The yield of groundnut was higher when grown without fertilizer than when fertilizer was applied and the yield showed a tendency to reduction with increasing plant population of maize.

The yield of groundnuts continues to be low. One main reason could be the late planting that was done at the Station. It is assumed that yields would be better if planting was done earlier and also if we were using varieties which have high yield potential.

CONCLUSION

This is the third year the study on plant population of maize has been conducted. It is evident that a maize plant population of about 44,000 plants would be appropriate for intercropping with the main crop being maize. There is, so far very little difference in response among the varieties used. These studies will hereby be suspended until there are new varieties of maize with different canopy structure.

5. THE EFFECT OF PHOSPHORUS SOURCE AND RATE OF MAIZE YIELD AND THAT OF THE SUCCEEDING BEAN CROP.

BACKGROUND

Different phosphate materials have different solubility rates and thus availability to the plants. The rate of solubility depends on,among other things, the soil reaction type. It is therefore quite important to determine the best phosphate source for the soils prevalent in a region before precise fertilizer recommendations are drawn.

The objective of the present study was to compare the effectiveness of the different sources of phosphorus with that of Togo Rock Phosphate on the yield of maize and to determine whether the initial effectiveness is carried over to the succeeding crop(s).

METHODOLOGY

The effects of Togo Rock Phosphate and a 50% partially acidulated derivative of it on yield of maize and that of the succeeding dry season crop were compared with that of single super phosphate. These were applied at 5 levels. The five levels were 25, 50, 75, 100 and 150 kg P_2O_5/Ha. Also included in the study were Triple Super Phosphate, Diammonium Phosphate and Bicalcium Phosphate at a single rate of 100 kg P_2O_5/Ha.

Nitrogen was applied in two splits at the rate of 120 kg/Ha and Potassium was applied at the rate of 60 kg/K_2O/Ha. Half of the Nitrogen and all the Potassium were applied 2 weeks after planting and the rest of the nitrogen applied 4 weeks later. The maize variety used was COCA and the trial was laid out as Complete Randomised Block with each treatment replicated four time. Maize was planted on flat at a plant population of 53,000 plants/Ha (inter-row spacing of 75cm and intra-row spacing of 25 cm). The trial was planted on March 27, 1986. Late season beans were planted on October 9, 1986 after maize was harvested and the stalks cut down. Beans were planted at the rate of 178,000 plants/Ha (37.5cm between rows and 5cm between plants to a row). Gramoxone was applied at the rate of 5 litres/Ha after the beans had been planted without tillage. The beans were harvested, January 1987. The results of the phosphate trial are presented in Table 10. There was no significant source by rate interaction. The discussion will, therefore be on the main effects of Phosphorus averaged over the various rates and the effect of the rates averaged over the Phosphorus sources. In the maize trial, Single Super Phosphorus application resulted in the highest maize yield (4.73 Ton/Ha). This was significantly greater than the yield obtained when Rock Phosphate and 50%

partially acidulated Rock Phosphate were applied (Table 10c). There was no significant difference on the yield of maize between the effect of Togo Rock Phosphate and 50% Partial Acidulation of the Rock. Applying only 25 kg of P_2O_5/Ha did not result in a significant increase in grain yield over the check. Phosphorus levels above 50 kg P_2O_5/Ha, however, resulted in increases in grain yield. In general, levels beyond 75% P_2O_5 had no effect on grain yield. In the case of Single Super Phosphate, however, increases in the amount of phosphorus resulted in increased grain yield.

The yields of beans resulting from the residual phosphorus followed a trend similar to that of maize (Table 10b). The highest yield of beans was obtained when Single Super Phosphate was applied at the rate of 150 kg P_2O_5/Ha. This was significantly higher than the yield obtained when 50% Partially Acidulated Rock Phosphate and when Rock Phosphate were applied. There was no significant difference betweer the yields obtained when the two Rock Phosphate sources were applied.

Applying 25 kg P_2O_5 had no significant effect on the yield of beans, but the rate of 50 kg P_2O_5 and higher, increased yield over the check. There was a progressive increase in grain yield with increasing levels of phosphorus although not proportionate. Again the greatest response was obtained when Single Super Phosphate was applied.

When different sources were compared at the rate of 100 kg P_2O_5/Ha, the highest yield of maize (5.07 Tons/Ha) was obtained when Single Super Phosphate was applied followed by the application of Triple Super Phosphate (Table 10b). The lowest yield was obtained with the application of Rock Phosphate. The highest yield of beans was obtained when Triple Super Phosphate was applied followed by when Single Super Phosphate was applied. The lowest yield was obtained with Bicalcium Phosphate.

CONCLUSION

The results obtained from the trial indicated that maize and beans respond to different sources and rates of phosphorus. The trend of the result is quite similar to that obtained in 1985/86 where Single Super Phosphate resulted in the highest yield and Togo Rock Phosphate had the lowest yield. This could be associated with the rate of solubility and thus the availability to crops. This could also have affected the rest of the sources. It is hoped that the results from soil samples taken during the season will explain this. Response to even high levels of phosphorus was not great. This could relate to the phosphorus fixing capacity of the soil or other deficiencies. The higher response to Single Super Phosphate than that to Diammonium Phosphate which should be more available implies that the crop is responding to other elements present in the Super Phosphates such as calcium and sulphur and not phosphorus availability alone. This perhaps explains why the yield of beans also followed the same trend. The site that was used seems to have poor internal drainage. Indeed, better yields were obtained in a neighbouring plot where the maize crop was planted on ridges. To overcome this problem, the crop will be planted on ridges in the coming season.

Soils at the site have a pH 5.2 which is quite low for maize. This suggests that we should obtain good results with Rock Phosphate where the inherent soil acidity acidulate the phosphate source instead of industrial acidulation.

That responses similar to those on maize were found on beans suggests that there is residual effect of the phosphorus sources which implies a possibility of good economic returns from these applications.

The results showed response to phosphorus. This response was highest with Single Super Phosphate and lowest with Rock Phosphate. Future work will be carried out to determine the nature of the demonstrated efficiency with Single Super Phosphate. Work will be done on the same plots with increased rates to determine whether the optimal rate lies beyond the rates used in the present study.

6. THE EFFECT OF SOURCE AND RATE OF NITROGEN ON MAIZE YIELD

The objective of the present study was to determine the response of maize to different sources and levels of nitrogen in order to establish the most economical source and rate of the nitrogen to the extension service. The information would be particularly relevant in maize production in areas with a long growing season and highly weathered soils which would be conducive to leaching losses.

M E T H O D O L O G Y

The effect of four sources of nitrogen applied at four different rates on maize yield was determined at all combinations. The four nitrogen sources were :

1) Prilled urea
2) Urea Super Granules (USG)
3) Calcium Ammonium Nitrate (CAN)
4) Sulphate of Ammonia;

and the four rates were 27, 55, 82 and 109 kg N/Ha. The nitrogen was applied in two splits, half at 2 weeks after planting and the rest at 6 weeks later.

Prilled Urea, Calcium Ammonium Nitrate and Sulphate of Ammonia were applied broadcast on either side of the maize rows incorporated making a small ridge about the plants. The Urea

Super Granules was applied in a hole on the side of the maize plant hills and covered with soil. The hole was 5cm off the maize row and 5cm deep. Phosphorus was applied at the rate of 120 kg P_2O_5 as Bicalcium Phosphate before planting and incorporated in the soil. Potassium was applied as Muriate of Potash at the rate of 60 kg K_2O/Ha two weeks after planting.

Application of Calcium Ammonium Nitrate resulted in the highest yield, followed by Urea Super Granules (TaLle 11). The lowest yield was obtained when Prilled Urea was applied. There was however, very little difference among the various sources and the differences were not significant at 5% probability level. Application of nitrogen increased grain yield of maize compared to the check. Applying 27 kg N/Ha increase maize yield by 11.6%. Further increases did not result in significant increases in yield except when nitrogen was applied at the rate of 109 kg N/Ha. The highest response to nitrogen was 40%. One would expect greater response especially as the land was previously cropped with unfertilized colocasia. The low yield of 5.01 Tons/Ha obtained with the highest level of nitrogen implies that other factors affected the response of maize of nitrogen levels among which high soil acidity and the associated deficiency and toxicity problems could have been responsible.

Better crop growth has been obtained when the crops are planted on ridges implying a possibility of internal drainage problems at the site. It is very difficult to draw conclusions from the present results especially as there is no distinct pattern. The trial will be repeated next year incorporating the soil amendment recommendations that will be obtained from soil analysis results and other planned modifications.

7. THE EFFECT OF FERTILIZER RATE, TIMING AND PLACEMENT ON MAIZE AND THE ASSOCIATED GROUNDNUT CROP: - BABUNGO 1986

The primary objectives of the study was to determine the fertilizer rate, timing and placement for maize and intercropped legume and on the second season crop. The information obtained would help in drawing recommendations for use on both station and on-farm trials.

METHODOLOGY

Two fertilizer rates were applied to a maize - groundnut intercrop at three timing levels using three placement methods. The fertilizer levels used were 300 and 600 kg of the commonly used fertilizer 20-10-10 (N-P-K). This was applied either all at planting, all at 5 weeks or a split application where half was applied at planting and the other 5 weeks after planting.

The fertilizer was applied in three different ways: (1) Broadcast and incorporated, banded in a drill in the seed furrow and covered lightly if applied at planting,or (2) banded on the side of the maize row and covered if applied 5 weeks after planting (band) or (3) placed in the seed hole and covered lightly if at planting and broadcast around the maize hill at a later application (point).

The maize variety Kasai I was the test variety planted at the plant population of 44,000 plants per hectare on two rows on a 1.5m wide ridge. A local groundnut variety was planted on the outer side of the maize rows at a spacing of 15cm between plants in a row.

RESULTS AND DISCUSSION

The trial was planted late (April 30th) and this affected the growth of groundnuts drastically. Only maize results will therefore be presented. Applying 300 kg 20-10-10 N-P-K/hectare resulted in an increase in maize yield of 44.7% (Table 12a). Doubling the fertilizer rate increased the yield of maize by a further 10.5% over the 300 kg application. The time of fertilizer application did not affect the yield of maize significantly although application at 5 weeks after planting only resulted in a slight reduction in yield when compared with other timings.

Broadcast application resulted in the lowest yield of maize. The highest yield was obtained when fertilizer was point applied around the plant followed by band application. Point application resulted in yield significantly greater than when the fertilizer as broadcast.

C O N C L U S I O N

The yield advantage of point placement is advantageous both at low and high fertilizer levels. This implies that there is no difference in fertilizer use efficiency between the two fertilizer rates used. That there was no difference in yield among the various timing of application might depend on the fertilizer used.

It might be necessary to split the application of fertilizers if different crops with different fertilizer demands are planted together, for example, in a situation where maize is grown with legumes it might be necessary to broadcast the phosphorus (or band it in between the maize and legume rows) and point apply the nitrogen. The different methods of application are likely to have different labour demand.

It is necessary to determine the economics of the application in relation to the cost of labour.

The trial will be repeated in the coming season to confirm the results and to study labour requirements.

8. THE EFFECT OF SUL-PO-MAG AND 20-10-10 COMBINATIONS ON MAIZE YIELDS

The fertilizer 20-10-10 is presently commonly used on food crops in the Western Highlands of Cameroon. Much as it could supply nitrogen, phosphorus and potassium in quantities sufficient for most crops, it does not supply other minerals that might be lacking in the soil. It would, therefore, have to be complimented with other fertilizer species that would supply other minerals. Such a fertilizer is Sul-Po-Mag: a fertilizer prepared and marked by the International Mineral and Chemical Corporation (IMC) of Mundelein, Illinois. One hundred kilograms of this product supplies 22kgs of sulphur and potassium and 11kg of magnesium. A combination of this product with 20-10-10 will therefore, supply magnesium and sulphur in soils where these elements would be deficient and at the same time increase the amount of potassium for the crops that require large amounts of this element such as grasses and tuber crops.

O B J E C T I V E

The main objective of the present study was to determine the effect of combining Sul-Po-Mag and 20-10-10 on the yield of maize and assess whether this is more economical than applying 20-10-10 alone.

M E T H O D O L O G Y

The effect of Sul-Po-Mag on maize yield was determined in combination with the commonly used fertilizer 20-10-10 at the rates of 100, 200 and 300kg of the product per hectare.

The trials was conducted at two sites: Bambui Plain (1330 m.a.s.l.) and Babungo (1176 m.a.s.l.). At Bambui Plain, COCA was the test variety and Kasai I was the test variety used at Babungo. Maize was planted at a plant population of 53,000 plants per hectare in plots of 22.5m^2 size.

All the fertilizer was broadcast and incorporated before planting.

Each treatment was replicated six times at Bambui Plain and five times at Babungo in a Complete Randomized Block Design. The crop at Bambui Plain was planted on April 4 and that at Babungo was planted on April 23, 1987. These dates were towards the late end of the recommended planting dates for the areas.

RESULTS

Averaged over the two locations, Sul-Po-Mag alone had no effect on yield of maize (Table 12a). Applying 300kg Sul-Po-Mag resulted in a slightly higher yield than when 600 kg/Ha was applied. Applying 300kg Sul-Po-Mag increased grain yield by only 6.5% whereas applying 300kg of 20-10-10 increased grain yield by 980 kg/Ha (23.5%).

At Babungo, applying 300kg of Sul-Po-Mag alone resulted in a non significant increase in grain yield of 410 kg/Ha (8.2%) and increasing the rate to 600 kg/Ha had no additional effect on yield. Application of 300kg 20-10-10/Ha resulted in a significant increase in grain yield of 1340 kg/Ha: an increase in yield of 27%. Applying 600kg of 20-10-10 resulted in a slightly higher yield than when only 300kg was applied. Application of 200kg of Sul-Po-Mag and 200kg of 20-10-10 resulted in grain yield only slightly lower than when 20-10-10 was applied at the rate of 600 kg/Ha, and significantly higher than the control. Increasing the amount to 300kg Sul-Po-Mag and 300kg 20-10-10 did not have additional effect at this site.

At Bambui Plain application of Sul-Po-Mag did not have any effect on maize yield, neither did the application of 20-10-10 (Table 12b). The results obtained indicate that Sul-Po-Mag alone is not sufficient to increase the yield of maize. Results from Babungo indicate that some advantage could be obtained if moderate rates of 20-10-10 and Sul-Po-Mag were combined.

Results from Bambui Plain were generally poor. This could be related to the low soil pH at the site (pH 5.2) the poor soil structure and the late planting with the associated water logging and low temperatures. Past soil analysis indicate that the soil at Bambui Plain is deficient in magnesium (0.28 meq/100 gms of soil as ammonium acetate extractable magnesium) whereas those at Babungo were well supplied with the element (2.28 meq). The lack of response at Bambui Plain could be due to other soil factors such as the amount of the phosphorus that was available to the plants and the effect of high concentration of aluminum.

More studies will be conducted to confirm the above results. The trial at Bambui Plain will be modified to include liming so as to increase the pH of the soil.

9. THE EFFECT OF LEGUME FALLOW ON MAIZE YIELD

BACKGROUND

Farmers in the Western Highlands grow crops continuously on the same piece of land until it is no longer fertile when they leave the land to fallow for a long period to regenerate fertility. If they planted legume during the fallow period they would have a faster soil fertility regeneration and nitrogen enrichment through symbiotic nitrogen fixation. There already exist a number of legumes in the area that could be used for this purpose.

The objective of the present study was to determine the effect on legumes planted during the fallow period would have on the yield of maize planted after the fallow.

Legume crops were planted at various times of the cropping season. Tephrosia vogelli, Crotalaria caricea, Mucuna utilis and a local sesbania were planted at three times, that is, at the beginning of the season, mid-season, and end of the season. Cowpeas, dry beans and soybeans were planted at the beginning of the dry season. The trial was located at Bambui Plain, Babungo and Befang.

All the legumes showed reasonable growth especially those planted during the first part of the season. Tephrosia, Crotalaria and Mucuna all showed good growth and yielded at least 7.0 Tons/Ha of dry matter. Sesbania, however, was not satisfactory since the germination was poor at all the sites.

The late season crops did not grow so well due to the prolonged rainy season and an abrupt cessation. Thus, the legumes were planted quite late and the abrupt stop resulted in severe drought that affected their growth.

CONCLUSIONS AND FUTURE STRATEGIES

The cover crops showed a lot of promise especially as far as using residual moisture is concerned. This still remains to be seen what their effect will be on the succeeding crop. This will be determined from the yields obtained from the maize crop that will be planted after the legumes next year. Legumes will be relay cropped with maize to determine their effect on both that of maize and the maize that will be planted in a subsequent season.

FUTURE PLANS

Most of the long term trials will be continued so as to determine the long term effect of the various treatments. Some of the short term trials will be concluded and properly documented.

The residue management trial will be continued for two more years after which the first phase (characterization of the various management practices) will be summarized. More work will be started to precisely identify which minerals are responsible for the increased yields when residue is burnt underground so that they can be supplied in mineral fertilizers. Treatments involving secondary and micro-elements will be included in the study.

The liming and phosphorus trial will be continued for one more year at the old site and about 2 years at the new site. Planting date trial will be expanded to include early and late varieties and streak and non streak resistant maize varieties. Sufficient information has been obtained about the effect of plant population on maize yield. Work on this trial will be suspended until new maize varieties with different morphology from those that exist presently and well adapted legume varieties have been obtained.

The effect of fertilizer timing and placement will be carried out for one more year and concluded.

More effort will be directed towards biological nitrogen fixation through legume fallow and alley cropping. This will involve the identification of suitable species and the cost/benefit of incorporating them in the farming system.

Table 1 : Rainfall statistics: Bambui Plain and Befang 1986.

	BAMBUI PLAIN		BEFANG	
	Total mm	No. of Days	Total mm	No. of Days
JANUARY				
FEBRUARY			81.5	2
MARCH			186.2	8
APRIL	85.2	7	146.2	20
MAY	126.8	16	270.8	24
JUNE	303.9	23	299.4	25
JULY	355.4	28	348.4	28
AUGUST	349.1	25	295.0	27
SEPTEMBER	346.4	28	240.3	29
OCTOBER	304.9	24	266.6	29
NOVEMBER	20.6	5	88.5	10
DECEMBER				
T O T A L	1892.3	156	2222.9	202

Table 2 : The effect of residue management and fertilizer application on the yield of maize (kg/ha) - Old Land 1986.

RESIDUE MANAGEMENT	FERTILIZER LEVELS (N-P-K) (KG/HA) 0-0-0	100-60-60	MEAN
BURY RESIDUE	3746	6457	5102 B
BURN RESIDUE AT SURFACE	4629	6369	5499 AB
BURN RESIDUE UNDERGROUND	5423	6505	5964 A
FERTILIZER MEAN	4599 B	6444 A	5522

LSD (0.05) (RESIDUE MANAGEMENT) = 482
LSD (0.05) (FERTILIZER) = 349
CV = 13.7%

Means in the same row and in the same column followed by the same letter are not significantly different at the 5% level according to Duncan's new multiple range test.

Table 3 : The effect of residue management and fertilizer application on the yield of colocasia - 1986.

RESIDUE MANAGEMENT	FERTILIZER RATE (KG N-P-K/HA)	YIELD OLD SITE	YIELD NEW SITE
a) BURY RESIDUE	0 - 0 - 0	11.34	15.37
	100-60-60	14.75	27.42
	200-120-120	--	41.70
MEAN		13.05	28.19
b) BURN RESIDUE AT SURFACE	0 - 0 - 0	10.46	23.18
	100-60-60	14.54	30.75
	200-120-120	--	31.41
MEAN		12.50	28.45
c) BURN RESIDUE UNDERGROUND	0 - 0 - 0	9.74	22.48
	100-60-60	13.65	36.71
	200-120-120	--	43.3
MEAN		11.7	34.16
MEAN		12.42	30.26
LSD (0.05) (RESIDUE MANAGEMENT)		6.02	6.04
LSD (0.05) (FERTILIZER		3.49	6.58
CV. RESIDUE		27.6	19.9%
FERTILIZER		40.01	25.4%

Table 4 : The effect of residue management and fertilizer application on the yield of maize (kg/ha).

New Land 1986

RESIDUE MANAGEMENT	FERTILIZER RATES (KG N-P-K/HA)			
	0-0-0	100-60-60	200-120-120	MEAN
BURY RESIDUE	3034	5977	7178	5397
BURN RESIDUE AT SURFACE	4143	6669	7500	6104
BURN RESIDUE UNDERGROUND	4012	6678	7382	6024
M E A N	3729	6441	7353	5842

LSD (0.05) RESIDUE MANAGEMENT = 678
LSD (0.05) RESIDUE MANAGEMENT = 440
CV RESIDUE MANAGEMENT = 20.14%
CV FERTILIZER = 13.24%

Table 5 : The relative effect of residue management and fertilizer on yield of maize and colocasia. Old site.

- % OF BURY RESIDUE

RESIDUE MANAGEMENT	FERTILIZER	YEAR		
		1984	1985	1986
MAIZE				
BURN RESIDUE AT SURFACE	- F	102.8	91.7	123.5
	+ F	114.0	115.7	98.6
BURN RESIDUE UNDERGROUND	- F	332.6	195.5	144.5
	+ F	164.8	112.9	100.8
COLOCASIA				
BURN RESIDUE AT SURFACE	- F	132.8	89.0	76.0
	+ F	100.9	88.4	106.8
BURN RESIDUE UNDERGROUND	- F	120.0	158.0	85.9
	+ F	78.3	115.0	100.0

THE BURY RESIDUE IS ASSUMED TO BE 100% FOR EACH OF THE FERTILIZER LEVELS.

Table 6 : Effect of residual lime and phosphorus on yield of maize and that of a succeeding bean crop (Kg/Ha). 3rd Year in Bambui Plain, 1986

LIME LEVELS	YIELDS	
Tons/Ha	Maize	Beans
0.0	2178 c	110 c
1.0	3632 b	217 b
2.0	4170 a	287 a
4.0	4316 a	311 a
MEAN	3574	236
LSD (0.05)	524	65
CV	21.1	40.0

P. LEVELS	YIELDS	
Kg P_2O_5/Ha	Maize	Beans
0	2837 b	193 b
50	3220	207 b
100	4025 a	264 a
150	4214 a	282 a
MEAN	3574	236
LSD (0.05)	524	65
CV	21.1	40.0

Table 7 : Effect of phosphorus application on yield of maize and a succeeding bean crop - 2nd Year New Land, 1986.

PHOSPHORUS LEVELS	YIELD KG/HA	
(Kg P_2O_5/Ha)	Maize	Beans
No Phosphorus added	7051 ab	503 bc
50 kg P + 100 kg P	7377 a	567 ab
50 kg P	6707 b	476 c
100 kg P + 100 kg P	7353 a	586 a
100 kg P	7106 ab	556 ab
150 kg P + 150 kg P	7519 a	605 a
150 kg P	7167 ab	512 bc
MEAN	7184	544
LSD (0.05)	520	60
CV	10.4	15.9

Table 8 : The effect of fertilizer and plant population on grain yield (Tons/Ha) of two maize varieties. Babungo 1986.

VARIETY	FERTILIZER N-P-K	PLANT POPULATION (X 1000) 33	44	53	67	MEAN	VARIETY MEAN
COCA	0-0-0	2.59	3.03	3.31	2.61	2.89	4.06 B
	80-60-40	4.36	5.28	6.13	5.15	5.23	
M E A N		3.48	4.16	4.72	3.88		
KASAI I	0-0-0	3.83	4.53	4.47	3.00	3.96	4.63 A
	80-60-40	4.63	5.39	5.60	5.53	5.29	
M E A N		4.23	4.96	5.04	4.27		
POPULATION MEAN		3.86 C	4.56 AB	4.88 A	4.08 BC		

LSD (0.05) VARIETY AND FERTILIZER = 0.40
LSD (0.05) POPULATION = 0.57
CV = 18.8%

Means in the same row or column followed by the same letter are not significantly different at the 5% probability level according to Duncan's new multiple range test.

able 9 : The effect of fertilizer and maize population on yield of the intercropped groundnut crop (Tons/Ha). Babungo 1986.

ARIFTY	FERTILIZER N-P-K	MAIZE PLANT POPULATION X 1000 33	44	53	67	MEAN	VARIETY MEAN
DCA	0-0-0	199.4	210.7	197.3	194.8	200.6	164.1
	80-60-40	149.9	129.0	101.2	130.3	127.6	
E A N		174.7	169.9	149.3	162.6		
ASAI I	0-0-0	241.0	141.1	169.0	160.8	178.0	143.3
	80-60-40	113.6	135.3	100.3	84.9	108.5	
E A N		177.3	138.2	134.7	122.9		
OPULATION MEAN		176.0	154.1	142.0	142.8	153.7	

SD (0.05) VARIETY = 15.3
SD (0.05) FERTILIZER = 15.3
SD (0.05) POPULATION = 21.6
SD (0.05) V x F x P = 43.3
= 20.3%

Table 10a : Effect of source and rate of phosphorus on yield of maize and a succeeding bean crop. Kambui Plain 1986.

	Maize Yield Tons/Ha	Bean Yield Kg/Ha
a. <u>PHOSPHATE SOURCE</u>		
Rock Phosphate	3.93 a	395 b
Single Super Phosphate	4.73 a	510 a
50% PARR	4.16 b	418 b
Yield of Check	3.13	363
MEAN	4.27	441
LSD (0.05)	0.51	40.4
CV	21.6	16.5

	Maize Yield Tons/Ha	Bean Yield Kg/Ha
b. <u>PHOSPHATE RATE</u>		
Kg P_2O_5/Ha		
25	3.66 b	392 c
50	4.08 ab	416 bc
75	4.44 a	441 abc
100	4.58 a	465 ab
150	4.60 a	492 a
MEAN	4.27	441
LSD (0.05)	0.66	52.2
CV	21.4	16.5

Table 10b : The effect of different sources of phosphorus on the yield of maize and that of a succeeding bean crop.

PHOSPHORUS SOURCES	MAIZE (TONS/HA)	BEANS (KG/HA)
1. Togo Rock Phosphate	4.19	426
2. Single Super Phosphate	5.33	285
3. 50% partially acidulated Rock - P	4.21	484
4. Triple Super Phosphate	5.07	538
5. Diammonium Phosphate	4.39	412
6. Bicalcium	4.68	406
MEAN	4.65	459
LSD (0.05)	1.10	137
CV	17.9	22.6

Note: Phosphorus was applied at the rate of 100 kg P_2O_5/Ha.

Table 11 : The effect of rate and source of nitrogen on maize yields (Tons/Ha) - Cameroon Highland 1986.

NITROGEN SOURCE	27	55	82	109	MEAN
Prilled Urea	4.18	3.58	4.10	5.27	4.28a
Calcium Ammonium Nitrate	3.92	4.40	4.68	5.00	4.66a
Urea Super Granules	4.15	4.23	4.67	4.97	4.51a
Sulphate of Ammonia	4.30	3.95	4.40	4.80	4.36a
M E A N	4.14bc	3.95c	4.46b	5.01a	4.45a

YIELD OF THE CHECK	=	3.57
LSD (0.05) (SOURCE AND RATE)	=	.41
CV.	=	15.03%

Means in the same column and in the same row followed by the same letter are not significantly different at the 5% probability according to Duncan's new multiple range test.

Table 12a : Effect of timing and placement of fertilizer on maize yield (Kg/Ha). Babungo 1987.

PLACEMENT	FERTILIZER RATE (kg 20-10-10/ha)		
	300	600	MEAN
Broadcast	4301 b	4515	4408 b
Band	4343	5003	4673 a
Point (ring)	4564	5070	4820 a
M E A N	4403 b	4864 a	

Yield of Unfertilized Check	= 3062
LSD (0.05) of Rate	= 215
LSD (0.05) of Placement	= 243
C.V.	= 9.8

Table 12b : The effect of Sul-Po-Mag and 20-10-10 on the yield of maize (Tons/Ha) 1987.

T R E A T M E N T S	L O C A T I O N S		
	Bambui Plain (1330)	Babungo (1176)	Mean
1. Check - No fertilizer added	3.37	4.97	4.17
2. 300kg - Sul-Po-Mag	3.49	5.38	4.44
3. 600kg - Sul-Po-Mag	3.37	5.29	4.33
4. 300kg 20-10-10	3.98	6.31	5.15
5. 600kg 20-10-10	4.22	6.58	5.40
6. 100kg Sul-Po-Mag + 100kg 20-10-10	4.12	5.32	4.72
7. 200kg " " " + 200kg 20-10-10	4.19	5.97	5.08
8. 300kg " " " + 300kg 20-10-10	4.15	6.07	5.11
MEAN YIELD	3.86	5.74	4.80
LSD 0.05	1.19	.708	
CV.	27.4	9.4	

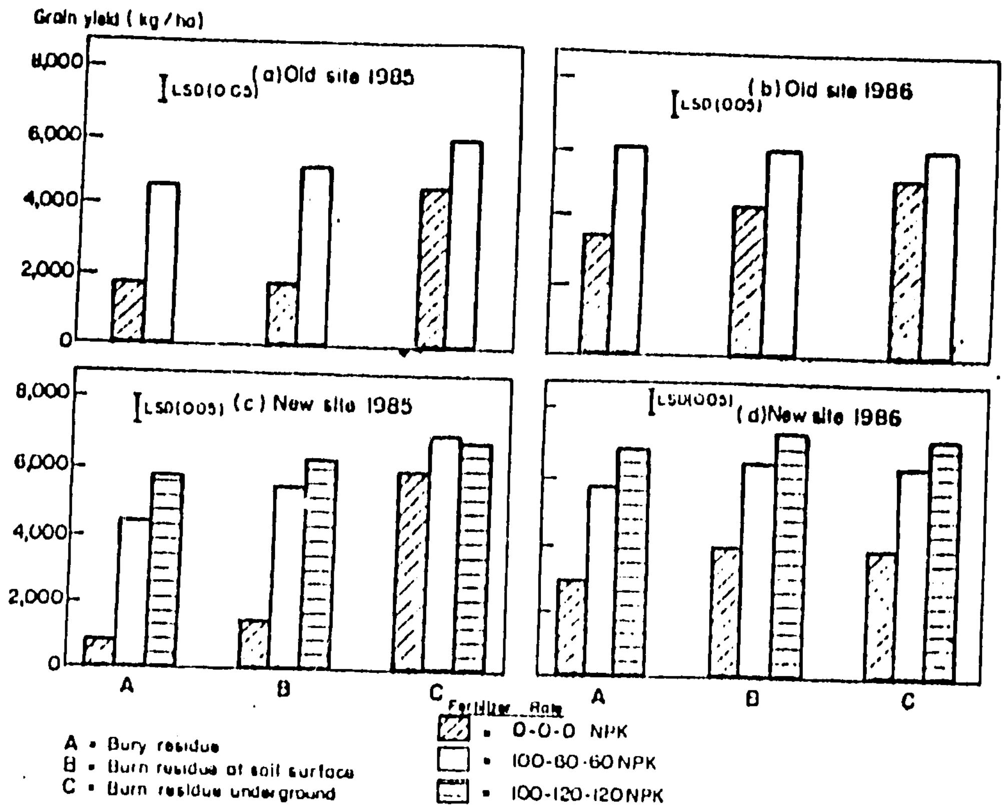

Figure 1: The effect of residue management and fertilizer rates on maize yield - two years study

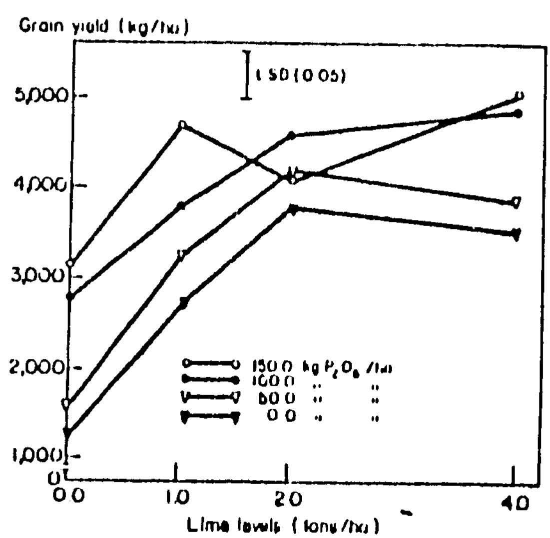

Figure 2 The effect of residual lime and phosphorus on maize yield old site 1986

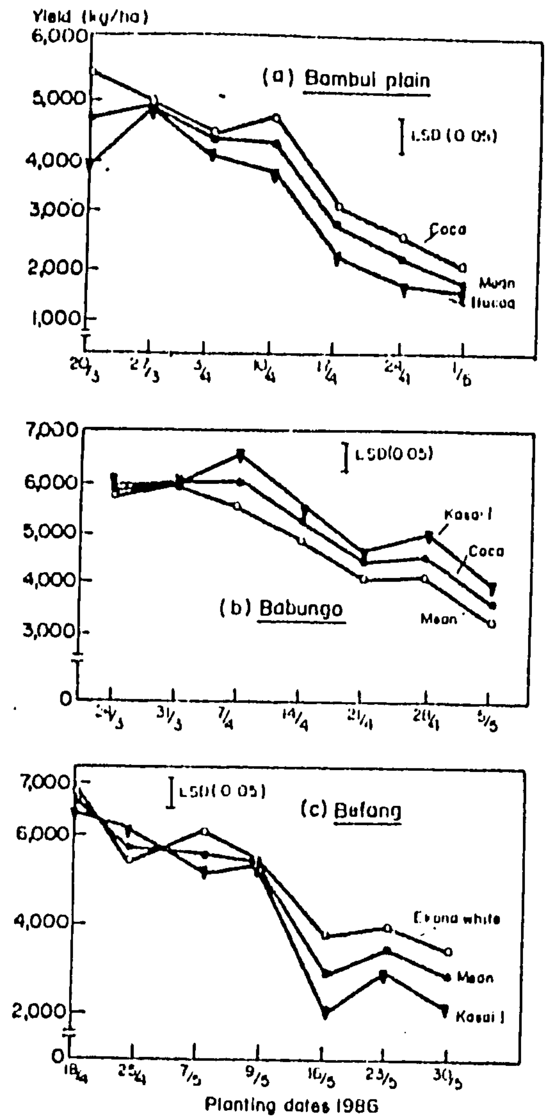

Figure. 3 The effect of planting date on the yield of maize at three locations.

SORGHUM AND PEARL MILLET BREEDING

INTRODUCTION

Sorghum and pearl millet are the major cereals cultivated throughout the three provinces of North-Cameroon. The importance of these cereals within this region increases as one moves from South to North corresponding closely with decrease in rainfall and shorter growing season. They are staple food for people of Northern Cameroon. Sorghum is also used as feed for animals and is an industrial raw material such as processing for beer and local drinks.

The current production of sorghum and pearl millet combined is about 424,325 metric tons annually. Rainy season sorghum constitutes about 70% of the total production. The transplanted sorghum grown on residual soil moisture in Vertisols known as Muskwari and pearl millet constitute 25% and 5% of total production, respectively. The yields of these crops in the traditional system are low, sorghum about 750 kg/ha and pearl millet about 585 kg/ha. None of these crops are grown by parastatal bodies and the bulk of production is by traditional farmers.

CONSTRAINTS IN SORGHUM AND MILLET IMPROVEMENT

A great amount of research work has been done in the past by the IRA sorghum and millet research team. On the basis of previous research, the major constraints identified in sorghum and millet production are as follows in order of priority :

- Lack of suitable varieties/hybrids with desirable agronomic and quality traits, resistant to various diseases and pests and tolerant/resistant to *Striga* and drought stress for different ecological zones of North-Cameroon.

- Lack of knowledge in land preparation, fertilizer application and weed and water management.

- Lack of knowledge in suitable cropping patterns and maintenance of soil fertility.

- Lack of technology in the transplanting of Muskwari sorghum in the Vertisols and weed control before transplanting.

- Socio-economic constraints in different ecological zones.

OBJECTIVE AND WORK PLAN OUTPUT

This is the fifth year of the Sorghum and Pearl Millet Improvement program of the IRA/IITA/USAID/NCRE Project in the North Cameroon. Research efforts continued with the primary objective being the breeding of suitable cultivars of sorghum and millet that can lead towards development of production systems of higher levels of yield performance and stability across a range of environments. These cultivars should be disease and pest resistant, of good grain quality, accepted by farmer, and tolerant/resistant to Striga and drought.

Efforts in the beginning of this year were also directed towards development of the solid basis for a national program in sorghum and pearl millet improvement in the North-Cameroon.

Particular emphasis is placed on the varietal improvement of sorghum and pearl millet as well as development of sorghum hybrids as agreed upon at the National Cereals Research Programs and Planning meeting held in Yaounde on March 3-9, 1986. IITA Scientists, USAID Officers, National Cereals Researchers of various disciplines, IITA/NCRE staff assigned to Cameroon and various implimenting agencies like SODECOTON, SEMRY, AGRI-LAGDO, various Benoue Projects and Ministry of Agriculture's officers in the North-Cameroon Provinces participated. The details of research work plan is given in NCRE Project's 1986 Work Plan. The output of 1986 work plan is discussed in details with each experiment along with the recommendation.

GENERAL STATEMENTS

With the onset of rains in the North, sorghum and pearl millet research began in Maroua at Guiring Research Station and various other locations in the Northern Provinces. The research activities cover three ecological zones as determined by rainfall (Fig. 1). Zone I has rainfall range of 300-800mm and in both sorghum and pearl millet are grown. Zone II and Zone III have rainfall ranges of 800-1000mm and 1000-1500mm, respectively and in both sorghum is grown. In general, Zone III has more area under maize among cereal crops.

The rainfall received during the 1986 crop season in various locations where sorghum and pearl millet experiments were conducted are presented in Table 2. The rainfall in the three ecological zones ranged from 587 to 1486mm (Figure 1).

The annual differences in rainfall at various locations for the four years (1982-86) is given in the Table 3. The rainfall received during 1986 was similar to that of 1982 and 1985 crop seasons but very uniformly distributed and was about 255mm more than the rainfall received during 1983 and 1984 crop seasons at various locations situated in the Extreme North Province (Semi-Arid Zone). This also indicated that the breeding program should continue to develop short cycle cultivars of sorghum and pearl millet crops for this zone. Similarly, the rainfall received during 1986 crops season for the sub-humid zone was about 75mm less than the rainfall received during 1983 and 1984 rainy seasons at various locations situated in the North-Province (sub-humid zone). This indicated that the breeding program should continue to develop the cultivars with the medium maturity cycle (100-130 days).

The soil type on the basis of French classification for all the locations where sorghum and pearl millet experiments were conducted are given in Table 4. The soil type varies from location to location. The soil type at Kousseri, and Karewa locations are very good for growing rice but it was observed to be average for rainy season sorghum because of high clay content which affects germination as the moisture is a limiting factor under rainfed conditions.

A C H I E V E M E N T S

The sorghum and pearl millet breeding program has the following successes achieved on the basis of 1986 research results :

- During the 1986 crop season, the sorghum improvement program succeeded in the initiation of sorghum hybrid program with the help of materials introduced from ICRISAT's on-going program. Thus, it also offers the scope for training of counterparts in hybrid development program.

- Based on the encouraging results of 1986, the sorghum varieties S-35, CS-54, CS-61 and CS-95 were accepted by the on-farm testing program for the Extreme North and North Provinces in the meeting of IRA, SODECOTON and Seed Multiplication Project during January, 1987. Furthermore, the Seed Multiplication Project has taken over the seed multiplication of these varieties during 1987 crop season.

- The variety S-35 of the sorghum improvement program has been taken over extensively by Sodecoton and the Ministry of Agriculture for large scale extension in the Extreme-North Province of North-Cameroon.

PROBLEMS ENCOUNTERED

The sorghum and pearl millet improvement program faced the following major problems during the 1986 crop season :

- Number of technicians attached to the sorghum and millet breeding unit are inadequate. Moreover, none has gone for training at international centres like ICRISAT in formal short-term training courses.

- There is an urgent need for cold room to maintain sorghum and pearl millet breeding materials as the temperature remains very high in North-Cameroon. Some of the breeding material lost the seed viability because of this natural factor.

- Non-availability of research materials, like pollinating bags for pearl millet did not allow us to follow the proper maintenance of breeding material during this crop season.

A. SORGHUM BREEDING

The details of sorghum breeding experiment conducted during rainy season of 1986 with date of sowing, number of entries, number of replications, plot size and locations are given in Table 5. All the experiments were sown in replicated trials, except F2's and advanced generations. The fertilizer application was uniform (60kg N; 30kg P_2O_5 and 30kg K_2O/ha) for all the experiments along with the interculture operations. Nitrogen was applied in two split doses, whereas P_2O_5 and K_2O were applied before sowing. The plant density was kept at 83,333 plants per hectare having a row to row distance of 80cm and plant to plant distance of 15cm. Four to five seeds were sown per hill. At final thinning, one plant per hill was maintained by transplanting for all the sorghum breeding experiments.

The data on days to 50% flowering, plant height, plant count at harvest, panicle count at harvest, panicle length, 1000 grain weight, harvesting index (hybrid trials), and grain yield were recorded and statistically analysed. The data on other traits like early vigor, plant count after final thinning, scores on diseases, pest, peduncle exertion, lodging, senescence and ovarall plant aspects were also recorded. The details regarding the scores for these traits are given in Table 6. The results and discussions in brief are presented below :

I - EXPERIMENTAL TRIALS - 1986

Trial 1 : West African Sorghum Variety Adaptation Yield Trial-I (Early Duration) :

Twenty entries were grown in a randomized complete block design consisting of three replications at Guiring Research Station, Maroua. S-35 promising exotic variety was included as check variety. The data on grain yield (kg/ha) and other traits are given in Table 7. The mean sum of squares due to genotypes were found significant at 1% level for all the traits, indicating wide genetic variability for these characters. None of the genotypes outyielded the check variety S-35 tested under this trial (Table 7). Genotype S-35 ranked first and yielded 6843 kg/ha followed by ICSV-1078 (6750 kg/ha), ICSV-1054 (6702 kg/ha), and ICSV-1065 (6070 kg/ha). The genotypes like S-35, ICSV-1078, ICSV-1054 and ICSV-1065 also matured early (less than 95 days) and were medium in plant height (Table 8). These genotypes were observed to be resistant to various foliage diseases like grey leaf spot (*Cercospora sorghii*), oval leaf spot (*Ramulispora sorghicola*), shooty strip (*Ramulispora sorghii*) and anthracnose (*Colletotrichum graminicola*). These genotypes were also found to be resistant to lodging and stem borer (*chilo partellus*) (Table 8). Therefore, these genotypes will be further used in our hybridization program to generate more breeding material of desirable characteristics.

Table 2 : West African Sorghum Variety Adaptation Yield Trial-II (Medium Duration) :

Twenty entries including exotic check variety S-34 were grown in a randomized complete block design with three replications at Agrilagdo, Karewa (North Province). The data on grain yield and other characters are presented in Table 9. The mean sum of squares due to genotypes were found highly significant at 1% level for the characters like days to 50% flowering and plant height revealing thereby wide genetic variability for these traits. Considering grain yield (kg/ha), six genotypes outyielded the exotic check variety S-34 but there was not significant difference in the grain yield. These genotypes are namely: IS 915, ICSH-1, ICSV-1044, ICSV-1038 and ICSV-1074. Moreover, these selections were observed to be medium in maturity cycle and tall in the plant height (Table 9). These new introductions were observed to be resistant to various foliage diseases and pests but were observed to be susceptible to grain mold and lodging. Therefore, these genotypes were discarded.

Trial 3 : West African Sorghum Hybrid Adaptation Yield Trial-1986 (ICRISAT Ouagadougou, Burkina-Faso) :

The objective of this hybrid trial was to find out ideal types of hybrids which will perform reasonably better compared with open pollinated varieties across different environments i.e.

high yielding hybrids possessing broad or wide adaptability and still exhibiting agronomically acceptable characters coupled with good grain quality acceptable to farmers.

Thirty six entries including two exotic checks (S-35 and S-34) and a local check variety Damougari were grown at two locations : Guiring Research Station, Maroua (Extreme North Province) and Agrilagdo, Karewa (North Province) in a 6 x 6 balanced lattice design consisting of three replications. The data for grain yield and other traits for both locations, Guiring and Karewa, are presented in Tables 10 and 12, respectively. The mean sum of squares due to genotypes were found highly significant at 1% level for plant height and harvesting index at Guiring location indicating wide genetic variability for these traits, whereas there was no significant difference for other traits at both locations. The data for various diseases and insect scores mean over locations are presented in Table 11. Considering the grain yield (kg/ha), the three hybrids, ICSH-311, ICSH-159 and CSH-5, gave 20 percent higher yield than the best exotic check variety S-35 at Guiring location (Table 10), whereas two hybrids, ICSH-228 and ICSH-231, gave more than 5 percent higher yield than the best exotic check variety S-34 at Karewa location (Table 12). These above mentioned high yielding hybrids at both locations were observed to be early in maturity cycle, medium in plant height, possessed longer and semi-loose panicles, and smaller grain as compared with those of exotic check variety S-35. Moreover, these hybrids were also observed to be resistant to various diseases and pests, lodging and good in overall plant aspects (Table 11). Therefore, the parents of these hybrids (A, B and R lines) were to be maintained and their hybrids along with other new hybrids developed during 1986 crop season will be tested during 1987 crops season for the reconfirmation of the results at both the locations in both the provinces.

Trial 4 : International Grain Mold Nursery - 1986 (ICRISAT, INDIA) :

The objective of grain mold nursery is to identify sources of stable, broad spectrum resistance to grain mold. To achieve this objective in our conditions, the sorghum grain mold nursery having 35 entries including S-35 and S-34 as check varieties were planted in one row plot in a randomized complete block design with two replications at IRA sub-station, Touboro. The data on days to 50% flowering, scores at panicle grain mold rating, mold rating at threshed grain and grain yield are presented in Table 13. The mean sum of squares due to genotypes were found highly significant for grain yield indicating wide genetic variability for this trait. Considering grain yield (kg/ha), the genotype IS-23585 ranked first and yielded 5262 kg/ha followed by IS-23599 (5100 kg/ha), IS-24955 (4600 kg/ha) and check variety S-35 (4137 kg/ha). The exotic check variety S-34 ranked 10th and yielded 3275 kg/ha. The above mentioned introductions were observed to have other desirable traits like medium maturity cycle, photoinsensitive, semi-loose panicle and good in overall plant aspects (Table 13). Considering the grain mold rating scores, the genotype SPV-104 was observed to have considerable more mold growth on rachis and glumes followed by IS 402, S-35 and S-34 (Table 13).

Trial 5 : National Sorghum Striga Nursery - 1986

Eleven entries including exotic check S-35 and *Striga* susceptible check CK 60 B were grown in a randomized complete block design consisting of four replications. The trial was conducted at NDONKOLE (near Maroua) farmer's field (same location since 1983 crop season) where the *Striga* population was sufficient to identify lines resistant to *Striga hermontheca* under field conditions. To create a sufficient *Striga* population, every year since 1983 crop season, *Striga* seed was also grown before sorghum planting every year. A checker board layout as a field screening technique against *Striga* suggested by ICRISAT was followed having number entries in each replication equal to 22 (10 test varieties plots + 12 plots of susceptible check variety arranged in checker board fashion). The details of similar layout were presented in the annual Reports of IRA/NCRE Project 1983 to 1985.

The data were recorded and statistically analysed for grain yield (kg/ha), days to 50% flowering, plant height, *Striga* count at harvest, plant count at harvest, head count at harvest, panicle length and 1000 grain weight and are presented in Table 14. The mean sum of squares due to genotypes were found significnat at 1% level for all the above mentioned characters indicating wide genetic variability for these characters. Considering the grain yield, the genotype Framida (resistant check) ranked first and yielded 3834 kg/ha followed by CS-54 (3423 kg/ha), S-34 (3401 kg/ha), CS-95 (3301 kg/ha) and CS-61 (3067 kg/ha). The genotypes like CS-54, S-34, CS-95 and CS-61 appeared to be resistant to *Striga hermontheca* when compared with *Striga* susceptible check CK 60 B (Table 14). Therefore, these genotypes seem to be promising for further use in our hybridization program to generate more breeding materials resistant/tolerant to *Striga hermontheca*. Moreover, the genotypes like S-35, CS-54 and CS-61 were observed to be very early (90 days), whereas CS-95 was observed to be medium in maturity duration (110 days), medium in plant height, good in all desirable morpholocal traits (Table 15) and grain quality aspects, resistant to various diseases and pests and confirmed the tolerance to *Striga hermontheca* which offer further scope for on-farm-testing in the semi-arid zone (90 days maturity cycle genotypes) and sub-humid zone (110 days maturity cycle genotype) of the North-Cameroon.

Trial 6 : Multilocation Sorghum Variety Adaptation Yield Trial - I (Early Duration - Extreme North Province) :

The objective of the variety trial was to find out what genotype grows best and where. This knowledge will help us to identify superior varieties for climatic zones. Some varieties will perform well only in specific areas, while some would perform reasonably well across different locations. These are ideal varieties, i.e., high yielding varieties possessing broad or wide adaptability and still exhibiting agronomically acceptable characters coupled with good grain quality acceptable to farmers.

On the basis of encouraging results from 1982 to 1985 at Guring Research Station and other locations in the semi-arid zone in the North-Cameroon, nine entries (early duration), consisting of a promising selection S-35 and a local check variety IRAT-55 which were already tested in 1983, 1984 and 1985 multilocation trial at ten, seven and six locations, respectively; four promising selections, CS-54, CS-57, CS-61, and 82-S-51, and a local check variety Damougari which were already tested in 1984 and 1985 multilocation trial at seven and six locations, respectively; a new early maturing selection and a hybrid were grown in a 3 x 3 Balanced Lattice design consisting of six replications at various locations: Guiring Research Station, Maroua; YOLDEO farmer's field; IRA sub-stations of Guetale, Soucoundou and Tchatibali and SEMRY-III, Kousseri (irrigated) having rainfall range of 300-800mm with widely differing soil types during 1986 rainy season. The data of this trial at Kousseri location (irrigated) were not reported because of heavy losses due to birds before harvesting.

The data on grain yield, days to 50% flowering, plant height, plant count at harvest, head count at harvest, panicle length and 1000 grain weight were statistically analysed for each of the five locations (Guiring, Yoldeo, Guetale, Soucoundou and Tchatibali) separately and are presented in Tables 16 to 20. The data on plant stand after thinning, diseases, insects and lodging scores were collected and are presented in Table 21 for all the five locations. The data on grain yield (kg/ha) and other agronomic characteristics over five locations were statistically analysed and are presented in Tables 22 and 23, respectively.

The mean sum of squares due to genotypes were found highly significant at 1% level for all the characters under study at each location (Tables 16 to 20), except head count at harvest/ha for Yoldeo location (Table 17) revealing thereby the presence of a considerable amount of genetic variability for these traits.

Considering the grain yield (kg/ha) over five locations (Table 22), selection CS-54 ranked first and yielded 4318 kg/ha followed by CS-61 (4109 kg/ha) and S-35 (4078 kg/ha). The local check varieties IRAT-55 and Damougari ranked 6th and 5th and yielded 3762 kg/ha and 3775 kg/ha, respectively. The selections like CS-54, CS-61 and S-35 were also found better in aspects like early maturity, medium in plant height, long semi-loose panicle, good peduncle exertion, tan type, good grain quality (white hold grain, without brown sub-coat with medium flint vitrosity) coupled with another plant aspect that of remaining green until maturity as compared with most of genotypes/varieties included in the experiment (Table 23). Furthermore, these selections namely: CS-54, CS-61 and S-35 were also found to be resistant to various foliage diseases like grey leaf spot, zonate leaf spot, shooty strip and anthracnose; and also to grain diseases particularly long smut and grain mold; and resistant/tolerant to stem borer, whereas IRAT-55 and Damougari were observed to have poor grain aspects and susceptible to various diseases and pests (Table 21).

Moreover, the mean performance of grain yield (kg/ha) over various promising selections of sorghum tested under this trial over years (1983 to 1986) and over locations (twenty nine locations) in the semi-arid zone of North-Cameroon were analysed and are given in Table 24. It is evident from the Table 24 that the selection S-35 ranked first and yielded 3748 kg/ha and gave 27.14% higher yield than the local check variety IRAT-55 which yielded 2948 kg/ha over twenty nine locations and four years indicating the higher level of yield performance and stability across a wide range of semi-arid zone (300-800mm) of North-Cameroon. Furthermore, the selection S-35 is not only a high yielder and stable in yield performance but also good from the point of view of plant type, grain quality, disease, insect and Striga aspects, and for drought stress. It offers scope for further agronomic studies and later extension of this variety along with its agronomic packages to farmers' fields in the wider areas of semi-arid tropics of North-Cameroon and similar ecological zones of the West and Central African countries.

Moreover, the selections like CS-54 and CS-61 which also ranked second and yielded 3602 kg/ha (over seventeen locations and three years) and gave 22.16% higher yield than the local check variety IRAT-55 which yielded 2948 kg/ha (Table 24) indicate higher levels of yield performance and stability across a wide range of semi-arid zone (300-800mm) of North-Cameroon. These selections are not only higher yielding and stable in yield performance, but also good from point of view of plant and grain quality; disease, insect and Striga aspects and offer scope for further agronomic studies and on pre-extension testing at farmers' fields in the wider areas of semi-arid tropics of North-Cameroon.

Trial 7: Multilocation Sorghum Variety Adaptation Yield Trial - II (Medium Duration North-Province) :

The objective of this trial was also to find out the ideal type of genotypes in high rainfall zone which will perform reasonably well across different locations i.e., high yielding varieties possessing broad or wide adaptability and still exhibiting agronomically and qualitatively acceptable characters to farmers' conditions of high rainfall zone of North-Cameroon (more than 900 isohytes).

On the basis of the encouraging results obtained in 1983 to 1985 of this variety trial, sixteen entries (medium duration) consisting of three promising selections namely: S-34, CS-60, CS-63 and an exotic check variety E 35-1 tested during 1983 to 1985 under this trial; five promising selections namely: ICSV-120, ICSV-126, ICSV-151, CS-84 and CS-85 which were tested during 1985 under this trial and six new selections from the breeding program along with a local check variety YOLOBRI were grown in 4 x 4 Balanced Lattice design consisting of five replications at various IRA sub-stations namely: Bere (North-East Benoue), Sanguere and Karewa (Centre of Benoue), Fignole (South-West Benoue) and Touboro (South-East Benoue) in the North Province; MBANG-BERNI in the Adamaoua Province and Babungo location under IRA Station Bambui in the North-West Province having rainfall range of more than 900mm with wide differing soil types. The local check variety YOLOBRI did not flower upto the time the experiment was harvested because of its long maturity cycle, therefore, statistical analysis were followed having fifteen entries in a randomized complete block design with five replications.

The data on grain yield, days to 50% flowering, plant height, plant and panicle count at harvest, panicle length, 1000 grain weight were statistically analysed for each location (Bere, Sanguere, Karewa, Fignole, Touboro and Mbang-Berni) separately and are presented in Table 25 to 30. The data on disease and insect scores were also collected and are presented in Table 31 for all the locations.

In general, most of the selection grown in this experiment were observed to be resistant to foliage disease, stem borer and lodging, whereas genotypes like A13120, Hybrid-Z and ICSV-151 were observed to be susceptible to grain mold and poor in early vigor (Table 31). The mean sum of squares due to genotypes were found highly significant at 1% level for all the characters under study at all the locations (Tables 25 to 30), except grain yield for Karewa location (Table 27) which was found significant at 5% level indicating presence of wide genetic variability for these traits.

The mean performance of grain yield (kg/ha) with rank and other characters over five locations of North Province (Bere, Sanguere, Karewa, Fignole and Touboro) were statistically analysed and are presented in Tables 32 and 33, respectively.

Considering the grain yield over five locations (Table 32), the selection A13120) ranked first and yielded 2343 kg/ha followed by CS-95 (2338 kg/ha), S-34 (2314 kg/ha), exotic check variety E 35-1 (2301 kg/ha) and CS-63 (2279 kg/ha). The selections like CS-95, S-34 and CS-63 were observed to have medium maturity (100-110 days), medium plant height (158 to 192cm), long and semi-loose panicle, good in grain quality as well as tan type coupled with another plant aspect that of remaining green until maturity (Table 33). The selection A13120 was observed to have early in maturity (less than 100 days), medium in plant height, semi-compact panicle and highly susceptible to grain mold (Tables 31 and 33). The exotic check variety E 35-1 was found to have semi-compact panicle which enhanced the losses due to midge pest. In general, most of the genotypes tested under this experiment were observed with decolourization of grain mold appearance which can be avoided by adjustment of date of planting in the Benoue where rainfall distribution has a long cycle (March-October). Therefore, the selections like CS-95, S-34 and CS-63 offer scope for further additional adaptational and agronomic studies on planting date and high fertility with high density in this high rainfall zone of Benoue to increase the sorghum production in this area.

Moreover, the mean performance of grain yield (kg/ha) of promising selections along with the exotic check E 35-1 over years (1983 to 1986) and over locations (seventeen in Benoue zone) were compiled and presented in Table 34. The selection S-34 ranked first and yielded 2665 kg/ha which was 21.69% higher yield compared with the best exotic check variety E 35-1 which yielded 2190 kg/ha over four years at seventeen locations in this zone (Table 34). This indicated the higher level of yield perfo-rmance and stability across a wide range of environments in the North Province. Furthermore, the selection is not only higher yielding and stable in yield performance but also good from the point of view of plant type, grain quality, disease and pest tolerance aspects, and offer scope for further agronomic studies particularly on date of planting (to avoid decolourization of grain due to grain mold appearance), high level of fertility (as moisture will not be a limiting factor) and also in mono and mixed cropping system with leguminous crops in the North-Province.

For the Adamaoua Province, this trial was conducted at IRA sub-station, Mbang-Berni with late planting at end of July, 1986. The data for grain yield and other characters are presented in Table 30. Considering the grain yield (kg/ha), the selection CS-84 ranked first and yielded 2551 kg/ha followed by E 35-1 (2441 kg/ha) and CS-60 (1831 kg/ha). These selections were observed to be late maturing (more than 120 days), dwarf in plant height and resistant to various diseases, pest and lodging. Therefore, these selections offer scope for further agronomic studies in this zone to increase the sorghum production.

For North-West Province, the same trial was conducted at Babungo location under IRA sub-station, Bambui. The trial was discarded because of poor germination and plant stand per plot after final thinning. Therefore, the trial will be repeated during 1987 crops season to reconfirm the 1985 results of various genotype tested under this experiment.

II - SELECTION AND HYBRIDIZATION

The long term objective of this program is to improve local varieties through artificial hybridization followed by selection. The breeding program was directed to meet two broad objectives i.e., the development of improved early varieties (80-95 days) for the semi-arid zone (less than 900mm rainfall) and the development of improved medium maturity varieties (100-130 days) for the sub-humid zone (more than 900mm rainfall).

I - SELECTION PROGRAMS

1. F_1 Generations :

In all, 55 crosses were developed during 1985 rainy season and off-season involving exotic x exotic, local x exotic and local x local genotypes with desirable traits via hand emasculation and pollination. These crosses along with their parents were grown in a randomized complete block design consisting of three replications at Guiring Research Station, Maroua, having a single row plot of 5 metres length in each replication. Some of the F_1 crosses have very poor germination because of poor seed viability and development. Therefore, out of 45 crosses, 37 crosses and their parents were selfed during rainy season to advance these crosses in F_2 generation (Table 35). Moreover, the data were recorded for various traits for genetical studies and the compilation of the data are in progress.

2. F_2 Generations :

The 15 F_2's crosses were grown having plant population of 2500-5000 plants for each cross to follow the selection program during 1986 rainy season. The selected plants were tagged and selfed and in all 110 single plants were harvested from all crosses after final selection (Table 35). These single plants were threshed separately and their F_3's single plant progenies will be grown during 1987 rainy season for further selection.

3. F_3 Generations :

In all 317 single plant progenies of 26 crosses in F3 generations selected during 1985 crop season were grown having 4-6 rows of 5 metres length during 1986 rainy season at Guiring Research Station, Maroua. The selection and selfing program was followed during the crop season. In all, 226 progenies of 25 crosses were harvested separately after final selection (Table 35). These progenies were threshed separately and their F_4 progenies will be grown during 1987 rainy season to follow further selection.

4. F_4 Generations :

The 69 progenies of 10 crosses selected during 1985 rainy season were grown having 4-6 rows of 5 metres length during 1986 rainy season at Guiring Research Station, Maroua. The selection and selfing program were followed during the crop season. In all, 28 progenies were selected and harvested (Table 35) to evaluate these in preliminary uniform progeny yield trials during 1987 rainy season.

2. - HYBRIDIZATION PROGRAMS

The objective of this program is to identify male sterile lines as well as restorers to develop superior hybrids of open pollinated varieties suitable to rainfed and irrigated conditions in the different ecological zones of North-Cameroon provinces. To meet this program objective, 45 B/A pairs of sorghum recently bred by Sorghum Improvement Program, ICRISAT Centre were introduced. These lines were derived from a wide array of B x B and B x R crosses (milo cytoplasm) and have undergone back-crossing for six generations. All these lines have a tan plant colour, white grain and dwarf plant height, photo-insensitive, early to medium maturity, stable male sterility and other desirable agronomic traits for good hybrids production. The 45 B/A pairs, 31 R-line (ICRISAT) and 10 open pollinated promising selections from our program as R-line were grown in a 4 row plots of 8 metres length during the rainy sea-son, 1986 at Guiring Research Station, Maroua. These ten promising selections/varieties were selected as parents (Restorers) based upon their performance in the 1982 to 1985 rainy seasons in the North-Cameroon and on the basis ofthe presence of desirable characteristics.

During the crop season, 30 B/A pairs of sorghum, all the R-lines were maintained by selfing and artificial pollination. Moreover, 88 hybrids were developed using these male sterile lines and the R-lines (31 introduced + 10 promising selections/ varieties). These hybrids will be grown during 1987 rainy season as a Hybrid Observation Nursery to study their yield performance in our ecological conditions of North-Cameroon.

B - MUSKWARI (TRANSPLANTED SORGHUM) PROGRAM

Sixty different collections of local muskwari sorghum were grown at three different dates of sowing, i.e. 10, 20th and 30th August, 1985 for nursery. All these collections were transplanted on 19th October, 1985 at IRA Salak Research Station near Maroua, to further reconfirm their yield potential and plant behaviour during dry season (October, 1985 to February, 1986). These collections were divided into two experiments having thirty collections each in the similar group like 1984-1985 crop season's experiments. All the thirty collections in each experiment were transplanted in a randomized complete block design with three replications. The plant density was kept at 40,000 plants per hectare having row to row distance of 100cm and plant to plant distance of 50cm with two plants per hill. No fertilizer was applied to the crop experiments.

The data on days to 50% flowering, plant height, plant and panicle count at harvest, panicle length and width, and other observations on grain and plant aspects were collected. The data on grain yield and other traits of both collection-I and II were analysed separately, and are presented in Tables 36 and 37, respectively. The results are presented in brief as follows :

<u>Trial 1</u> : Evaluation of Genetic Collection of Muskwari - I (1985-86) :

It is evident from Table 36 that genotypic differences were found highly significant for almost all the characters studied except grain yield (kg/ha) indicating wide genetic variability for these traits. Considering the grain yield, the genotype SAF-14 ranked first and yielded 3916 kg/ha followed by Yag.-I (3562 kg/ha), Bourg.-28 (3475 kg/ha), Bourg.-54 (3470 kg/ha) and SAF.-6 (3304 kg/ha). The check variety SAF.-40 ranked 10th and yielded 3037 kg/ha. These collections were also observed to be early in maturity (90-100 days after transplanting), medium in plant height (150cm), medium in panicle length, wide in panicle width (Table 36), good in grain quality aspects and resistant to various diseases and pests and, thus, offer scope for further genetical and agronomic studies.

<u>Trial 2</u> : Evaluation of Genetic Collection of Muskwari - II (1985-86) :

The mean sum of squares due to genotypes were found significant at 1% level for all the characters, except plant height and panicle width indicating wide genetic variability for these traits (Table 37). Considering the grain yield, the genotype Madj.-1 ranked first and yielded 3256 kg/ha followed by the check variety SAF.-40 which yielded 3037 kg/ha. The other introductions from Senegal like Bambey-1 to Bambey-5 yielded less than 600 kg/ha. The selections from Madjeri group were also observed to be early in maturity, medium in plant height, small to long in panicle length, wide in panicle width (20-25cm) and good in grain quality aspects, thus, offer further scope for genetic and agronomic studies to enhance the grain production of muskwari crop.

C - PEARL MILLET BREEDING PROGRAM

The pearl millet experiments approved by the National Sorghum and Pearl Millet Meeting held in Yaounde on 3-9 March, 1986 were planted on 5th July, 1986 at Guiring Research Station, Maroua, except the International Pearl Millet Zone, a trial from ICRISAT because of non-arrival of the seed. The results are presented and discussed below :

1. Advanced Generations

All advanced generations (96 F_3s and F_4s generations) introduced from ICRISAT, Naimey and six F_1s inter-specific crosses from Tifton Georgia University's Pearl Millet Program were grown in 5 metres row length and number of rows according to seed availability (4-10 rows). No fertilizer was applied. The plant density was kept at 41,606 plants per hectare having a row to row distance of 80cm and plant to plant distance of 30cm. Three to four seeds were sown per hill. At final thinning one plant per hill was maintained for all these advanced generations. During crops season, the selections and selfing programs were followed. In general, the selfed seed were obtained from tillers because the pollinating bags for pearl millet were received very late. The self heads from each plants/progenies were harvested separately for further selection program (Table 38).

2. Uniform Progeny Nursery - 1986 (ICRISAT, INDIA) :

The main objective of this nursery is to identify parents with desirable characters for crossing with adapted varieties, to test in hybrid combinations or for use as synthetics in our national program.

The 100 entries including exotic check G73-K77 and local check Mouri (repeated checks after every 10 entries) were grown in a 2 row plot of 5 metres length having plant density of 41,666 plants per hectare. During crop season, selection and selfing programs were followed. In all 13 progenies out of 100 progenies were harvested after final selections. These will be grown as preliminary yield trial during 1987 crops season with local check variety Mouri (Tahle 38).

Table 1 : Statistical data on production and areas under sorghum and pearl millet crops in North Cameroon.

CROPS	YEAR	CULTIVATED AREA (HA)	GRAIN YIELD (TONS)	GRAIN YIELD (KG/HA)	AVERAGE YIELD OVER YEAR (KG/HA)
SORGHUM	1978-1979	320,840	266,710	813	852
(Rainy Season)	1979-1980	369,570	253,090	817	
	1980-1981	358,819	379,272	1057	
	1981-1982	377,250	291,325	772	
	1982-1983	386,767	309,412	799	
	1983-1984	389,747	374,680	901	
	1984-1985	330,996	215,445	650	
	1985-1986	348,470	351,215	1007	
SORGHUM	1978-1979	128,110	117,220	915	723
(Muskwari)	1979-1980	121,840	92,815	762	
	1980-1981	133,636	132,290	985	
	1981-1982	111,195	60,343	542	
	1982-1983	109,722	54,860	499	
	1983-1984	114,612	63,957	558	
	1984-1985	67,242	44,000	654	
	1985-1986	89,172	77,937	874	
PEARL MILLET	1978-1979	41,450	24,950	602	585
	1979-1980	47,820	24,925	521	
	1984-1985	55,871	27,340	489	
	1985-1986	92,942	67,809	729	

Source : Provincial Delegations of Agriculture.

Table 2 : Monthly rainfall distribution and days (in parenthesis) of various North-Cameroon locations during, 1986.

LOCATIONS	RAINFALL (MM) MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPT.	OCT.	NOV.	TOTAL
IRA GUIRING (MAROUA)	0.5	2.5	40.4	136.5	189.3	270.4	143.5	3.4	-	783.5
	(1)	(1)	(7)	(13)	(9)	(17)	(10)	(1)	-	(59)
IRA GUETALE	17.5	22.5	29.4	99.0	190.3	173.3	103.2	-	-	635.2
	(1)	(2)	(4)	(6)	(13)	(14)	(13)	-	-	(53)
IRA MAKEBI	-	11.5	32.2	121.9	157.7	174.3	126.1	23.6	-	679.3
	-	(4)	(6)	(11)	(13)	(14)	(15)	(2)	-	(65)
IRA TCHATIBALI	-	0.4	41.9	119.2	253.7	307.3	232.9	36.6	-	992.4
	-	(1)	(5)	(7)	(11)	(16)	(12)	(2)	-	(54)
IRA SOUCOUNDOU	-	15.6	76.2	137.6	178.6	154.7	292.9	32.1	-	937.9
	-	(1)	(8)	(10)	(14)	(15)	(17)	(4)	-	(69)
IRA SANGUERE	-	11.3	64.6	107.4	294.2	243.5	136.4	33.8	0.2	891.7
	-	(3)	(7)	(11)	(13)	(13)	(14)	(4)	(1)	(66)
IRA BERE	1.0	30.0	47.5	187.0	173.6	316.0	174.0	76.0	3.0	1018.3
	(1)	(2)	(7)	(10)	(12)	(12)	(11)	(5)	(1)	(61)
IRA FIGNOLE	-	44.0	60.0	143.	178.	235.5	257.0	175.0	-	1092.9
	-	(5)	(6)	(11)	(11)	(12)	(14)	(5)	-	(63)
IRA N'DOCK	29.0	66.5	73.0	139.0	361.5	358.0	239.0	157.5	43.0	1486.5
	(4)	(6)	(12)	(13)	(17)	(19)	(17)	(10)	(2)	(102)
IRA TOUBORO	39.6	38.9	53.5	119.0	345.1	235.5	110.3	61.7	17.5	1030.0
	(5)	(4)	(13)	(14)	(19)	(17)	(13)	(8)	(2)	(92)
AGRI-LADDO, KAREWA	0.7	30.9	31.2	70.0	178.5	208.1	210.4	27.5	-	757.3
	(1)	(6)	(7)	(10)	(14)	(13)	(16)	(15)	-	(72)
IRA TCHOLLIRE	19.0	14.5	104.6	162.5	263.5	186.0	264.5	206.0	-	1164
	(2)	(4)	(10)	(11)	(15)	(14)	(15)	(7)	-	(79)
AVERAGE OVER LOCATIONS	9.94	22.41	54.65	133.85	229.55	238.75	193.27	73.67	5.31	957.4

Table 3 : Annual rainfall differences of various locations in different provinces of North Cameroon.

PROVINCE/LOCATIONS	RAINFALL (MM)				
	1982	1983	1984	1985	1986
A - <u>EXTREME NORTH</u>					
IRA GUIRING	542.6	473.6	408.8	611.8	783.5
IRA GUETALE	794.3	638.0	716.9	801.7	635.2
IRA MAKEBI	588.6	475.4	604.6	668.9	679.3
IRA TCHATIBALI	781.0	491.5	525.3	581.0	992.4
IRA SOUCOUNDOU	1093.3	880.2	794.7	803.8	937.9
SEMRY II, MAGA	560.0	416.0	237.0	492.4	-
SEMRY III, KOUSSERI	420.0	350.6	178.5	480.4	587.1
AVERAGE OVER LOCATIONS	682.7	532.2	495.1	634.2	769.2
B - <u>NORTH PROVINCE</u>					
IRA SANGUERE	969.7	697.1	854.6	864.0	891.7
IRA BERE	726.0	896.0	778.1	945.9	1018.3
AGRILAGDO, KAREWA	980.0	786.9	808.5	1118.3	757.3
IRA FIGNOLE	1016.7	998.9	898.3	1289.2	1092.9
IRA N'DOCK	1470.3	885.9	1013.5	1291.5	1486.5
IRA TOUBORO	1236.7	990	951.0	1599.0	1030.0
AVERAGE OVER LOCATIONS	1066.5	875.8	884.0	1184.6	1046.1

Table 4 : Soil type at various locations where sorghum and millet experiments were conducted at different ecological zones of North Cameroon.

LOCATIONS	FRENCH CLASSIFICATION*
IRA GUIRING	ALLUVIONS RECENTES
IRA GUETALE	ALLUVIONS PEU EVOLUEES
IRA TCHATIBALI	SOL FERRUGINEUX
IRA SOUCOUNDOU	SOL ROUGE TROPICAL
IRA BERE	PLANO SOLS TROPICAUX NON LESSIVES
AGRI.AGDO KAREWA	FERRUGINEUX LESSIVES
SEMRY-II MAGA	SOL PEU EVOLUES NON CLIMATIQUE D'APPORT ALLUVIAL
	ALLUVIONS ARGILO-LIMUNEUSES
SEMRY-III KOUSSERI	VERTISOLS
FARMERS' FIELD YOLDEO	ALLUVIONS RECENTES
NDONKOLE NEAR MAROUA	FERRUGINEUX SUR CUIRASSE
IRA FIGNOLE	FERRUGINEUX TROPICAL LESSIVE
IRA N'DOCK	FERRUGINEUX TROPICAL LESSIVE
IRA TOUBORO	FERRUGINEUX TROPICAL LESSIVE
IRA MBANG-MBOUNG	SOL FERRALLITIQUE TYPIQUE MODAL SUR BASALTE

* FRITZ ET VALLERY, 1970 : "CONTRIBUTION A L'ETUDE DES DEFICIENCES MINERALES SOUS CULTURE COTONNIERE DU NORD CAMEROON.

Table 5 : List of sorghum trials and nurseries planted during rainy season, 1986.

SERIAL NUMBER	NAME OF TRIALS/NURSERY	DATE OF SOWING	No. OF ENTRIES	PLOT SIZE	No. OF REPS.	L O C A T I O N
1	West African Sorghum Variety Adaptation Yield Trial-86 (Early Duration)	27.6.86	20	5 x 3.2m	3	IRA MAROUA
2	West African Sorghum Variety Adaptation Yield Trial-86 (Medium Duration)	7.7.86	20	5 x 3.2m	3	AGRILAGDO KAREWA
3	West African Sorghum Hybrid Adaptation Yield Trial-86	27.6.86	36	5 x 3.2m	3	IRA MAROUA
4	Sorghum Grain Mold Disease Resistance Nursery - 86	2.7.86	35	5 x 1.6m	2	IRA TOUBORO
5	National Sorghum <u>Striga</u> Nursery-86	5.7.86	11	5 x 1.6m	4	NDONKOLE Near MAROUA
6	Multi-location Sorghum Variety Adaptational Yield Trial-1 (Early Duration Semi-Arid Zone - Extreme North)	27.6.86	9	5 x 4.8m	6	IRA MAROUA
		11.7.86	9	5 x 4.8m	6	YOLDEO FARMER'S FIELD
		21.6.86	9	5 x 4.8m	6	IRA TCHATIBALI
		16.7.86	9	5 x 4.8m	6	SEMRY III KOUSSERI
		1.7.86	9	5 x 4.8m	6	IRA GUETALE
		21.6.86	9	5 x 4.8m	6	IRA SOUCOUNDOU
7	Multi-location Sorghum Variety Adaptation Yield Trial-II (Medium Group-North, Adamaoua and Northwest Provinces	28.6.96	16	5 x 4.8m	5	IRA BABUNGO
		7.7.86	16	5 x 4.8m	5	AGRILAGDO KAREWA
		4.7.86	16	5 x 4.8m	5	IRA BERE
		25.6.86	16	5 x 4.6m	5	IRA SANGUERE
		1.7.86	16	5 x 4.8m	5	IRA FIGNOLE
		2.7.86	16	5 x 4.8m	5	IRA TOUBORO
		29.7.85	16	5 x 4.5m	5	IRA MBANG-BERNI
8	Crossing Program	19.6.86	22	20 x 4.8m	-	IRA MAROUA
		24.7.86	22	8 x 40m	-	IRA MAROUA
9	Hybrid Program	28.6.86	66	8 x 1.6m	-	IRA MAROUA
10	F1 Generation and their parents	5.7.86	55	5 x 0.8m	3	IRA MAROUA
11	F2 Generation	2.7.86	14	-	-	IRA MAROUA
12	F3 Generation	28.6.86	318	-	-	IRA MAROUA
13	F4 Progenics	27.6.86	72	-	-	IRA MAROUA
14	Development of Breeder's Seed of Advanced Sorghum and Millet Lines.	27.6.86	12	80 x 40m	-	IRA MAROUA

Table 6 : Details of scores for various characters recorded for sorghum experiments conducted during rainy season, 1986.

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1. DISEASES SCORES
   - 0 = Resistant
   - 1 = Less than 5%
   - 2 = 5 - 10%
   - 3 = 11 - 25%
   - 4 = 25 - 40%
   - 5 = More than 41%

2. LODGING
   - 0 = None
   - 1 = 10% of the plants lodged
   - 2 = 11 - 15% of the plants lodged
   - 3 = 26 - 50% of the plants lodged
   - 4 = 51 - 75% of the plants lodged
   - 5 = 76 - 100% of the plants lodged

3. SENESCENCE
   - 1 = All green leaves
   - 2 = Few lower leaves dead
   - 3 = About half of leaves dead
   - 4 = More than half of leaves dead
   - 5 = All leaves dead

4. OVERALL PLANT ASPECT
   - 1 = Very good
   - 2 = Good
   - 3 = Average
   - 4 = Below average
   - 5 = Poor

5. PEDUNCLE EXERTION
   - 1 = Well exerted more than 10cm between legule of the flag leaf and ear base
   - 2 = Exertion 2 to 10cm between legule of flag leaf and ear base
   - 3 = Less than 2cm, but legule definitely below the panicle base
   - 4 = Peduncle recurred, but panicle is below the legule and clearly exposed, spliting the leaf sheath
   - 5 = Ear covered by the leaf sheath

6. EARLY SEEDLING VIGOR
   - 1 = Very good
   - 2 = Good
   - 3 = Average
   - 4 = Below average
   - 5 = Poor

Table 7 : TRIAL-1 : West African Sorghum Variety Adaptation Yield Trial - 1986 (early duration)

LOCATION : Guiring Research Station, MAROUA

SOURCE : ICRISAT, OUAGADOUGOU, BURKINA-FASO

ENTRIES		GRAIN** YIELD (KG/HA)	RANK	DAYS TO** 50% FLOWERING	PLANT** HEIGHT (CM)	HEAD** COUNT AT HARV./HA	PANICLE** LENGTH (CM)	1000 GRAIN** WEIGHT (GRAMS)
ICSV-2 HV	...	4458	18	58	128	78333	23	21.57
ICSV-7-1	...	4714	14	62	246	107916	26	24.10
ICSV-16-3	...	5118	10	65	307	99583	27	28.43
ICSV-16-5	...	4775	13	61	317	79166	25	27.83
ICSV-85-2	...	5706	5	59	189	86666	27	23.05
ICSV-84-1	...	4670	15	56	196	86250	25	29.08
ICSV-1031	...	5645	6	57	212	83750	33	28.78
ICSV-1045	...	4875	11	60	195	80000	30	22.53
ICSV-1054	...	6702	3	58	217	84166	28	21.60
ICSV-1055	...	5629	7	59	221	89166	30	21.38
ICSV-1060	...	4506	17	56	212	92083	25	27.62
ICSV-1061	...	4512	16	57	204	87500	25	22.74
ICSV-1062	...	5654	6	64	275	84166	29	26.03
ICSV-2064	...	5158	9	55	266	94166	28	22.19
ICSV-1065	...	6070	4	57	255	95416	28	24.36
ICSV-1078	...	6750	2	55	176	103750	33	22.45
IRAT 203	...	5545	8	65	193	134166	28	21.71
MALISOR 84-7	...	4012	19	59	134	93333	29	18.75
ICSH-1	...	4833	12	57	192	62916	32	17.88
S-35 (EX. CHECK)	...	6843	1	59	243	65833	25	32.39
OVERALL MEAN	...	5308		59	219	91416	28	24.22
L.S.D. AT 5%	...	912.52		3.01	44.64	23655.14	5.56	2.03
C.V. %	...	10.40		3.07	12.33	15.79	11.99	5.08

* SIGNIFICANT AT 5% LEVEL.
** SIGNIFICANT AT 1% LEVEL.

Table 8 : TRIAL 1 : West African Sorghum Variety Adaptation Trial - 1986 (early duration)

SOURCE : ICRISAT, OUAGADOUGOU, BURKINA FASO

LOCATION/ENTRIES	GUIRING			
	PLANT STAND AFTER THINNING	DISEASE SCORES (0-5)	INSECT SCORES (0-5)	LODGING
ICSV - 2H	51	5.0	2.3	0.0
ICSV 7 - 1HV	48	2.6	1.0	3.0
ICSV 16 - 3HV	55	4.6	2.0	1.6
ICSV 16 - 5HV	55	4.3	2.3	2.3
ICSV 85 - 2HV	49	1.3	1.3	0.3
ICSV 94 - 1HV	52	3.3	0.6	0.0
ICSV 1031HV	47	2.3	1.0	1.3
ICSV 1045HV	47	3.0	1.6	0.0
ICSV 1054HV	44	2.0	1.0	0.6
ICSV 1055HV	41	3.6	2.0	2.0
ICSV 1060HV	50	50	2.3	1.0
ICSV 1061HV	46	3.0	1.6	1.0
ICSV 1062HV	51	2.6	1.0	0.6
ICSV 1064HV	46	2.6	1.3	2.3
ICSV 1065HV	47	2.3	1.6	1.6
ICSV 1078HV	48	2.6	1.3	0.3
IRAT 203	51	1.6	0.3	0.6
MALISOR 84-7	52	1.6	2.0	0.0
ICSH - 1	51	3.0	0.6	0.0
S - 35 (EX. CHECK)	52	1.0	0.0	0.0

Table 9 : TRIAL 2 : West African Sorghum Variety Adaptation Yield Trial - 1986 (medium duration)

LOCATION : AGRILAGDC, KAREWA

SOURCE : ICRISAT, OUAGADOUGOU, BURKINA-FASO

ENTRIES		GRAIN** YIELD (KG/HA)	RANK	DAYS TO** 50% FLOWERING	PLANT** HEIGHT (CM)	HEAD** COUNT AT HARV./HA	PLANT COUNT AT HARV./HA
ICSV-23 HV	...	1337	18	68	207	43333	56111
ICSV-1038 HV	...	2171	5	73	210	62222	71666
ICSV-1044 HV	...	2461	3	66	199	58888	73888
ICSV-1047 HV	...	1908	12	75	271	60000	70555
ICSV-1056 HV	...	1962	9	73	259	63888	70555
ICSV-1057	...	2040	8	74	213	55555	66666
ICSV-1058	...	1112	19	76	235	45000	58888
ICSV-1063	...	2251	4	72	232	54444	58888
ICSV-1067	...	1648	15	78	230	57777	63333
ICSV-1070	...	1344	17	77	285	45555	61111
ICSV-1074	...	2058	6	74	222	57777	61111
ICSV-1077	...	1936	10	76	241	57222	71666
ICSV-1080	...	1715	13	72	200	50000	63888
PM 11344	...	1495	16	74	240	39444	57222
IRA-277	...	1012	19	70	215	49444	72222
IS 915	...	2847	1	57	178	66666	79444
ICSV 126	...	1675	14	75	235	59444	67222
ICSV 2 IN	...	1916	11	75	262	55555	71111
ICSH-1	...	2548	2	69	206	71111	77222
S-34 (EXOTIC CHECK)	...	2052	7	71	208	52777	63888
OVERALL MEAN	...	1874.7		72.8	227.8	55305.5	66833.3
L.S.D. AT 5%	...	1091.5		6.8	29.76	21799.0	14630.4
C.V. (%)	...	35.23		5.65	7.91	23.85	13.24

** Significant at 1% level.

Table 10 : TRIAL-3 : West African Sorghum Hybrid Adaptation Yield Trial - 1986

LOCATION : Guiring Research Station, MAROUA

SOURCE : ICRISAT, OUAGADOUGOU, BURKINA-FASO

ENTRIES		GRAIN YIELD (KG/HA)	RANK	DAYS TO 50% FLOWERING	PLANT** HEIGHT (CM)	HEAD COUNT AT HARV./HA	PLANT COUNT AT HARV./HA	PANICLE LENGTH (CM)	1000 GRAIN WEIGHT (GRAMS)	HARVEST** INDEX
ICSH-208	...	5100	30	56	168	70416	65416	36	22.12	0.30
ICSH-221	...	5416	21	57	178	77916	77916	36	23.96	0.33
ICSH-228	...	5745	14	57	208	84583	77916	35	23.47	0.31
ICSH-229	...	5977	8	58	175	76666	73750	35	22.25	0.29
ICSH-230	...	5733	16	60	182	85833	79583	35	23.67	0.28
ICSH-231	...	5566	18	57	193	77500	76250	35	23.49	0.29
ICSH-232	...	5683	17	58	158	75000	70000	35	27.43	0.25
ICSH-241	...	4429	36	56	185	84166	74583	34	19.39	0.27
ICSH-357	...	4685	35	56	201	96666	82916	33	21.43	0.28
ICSH-358	...	5797	12	59	196	76666	72916	33	21.54	0.31
ICSH-359	...	6072	5	61	220	92500	91250	33	28.48	0.26
ICSH-259	...	5912	10	60	185	80000	74583	33	22.20	0.27
ICSH-260	...	4958	32	56	186	79583	75000	33	24.41	0.28
ICSH-263	...	4975	31	55	176	78750	70416	32	21.89	0.27
ICSH-284	...	5250	24	56	154	77500	77083	32	23.15	0.29
ICSH-285	...	5229	25	59	194	79583	78750	32	22.81	0.24
ICSH-287	...	5154	29	57	180	75833	75000	31	24.99	0.30
ICSH-290	...	5445	20	57	177	85416	82500	31	21.55	0.29
ICSH-299	...	5741	15	59	202	75000	72083	31	26.82	0.25
ICSH-305	...	5206	27	57	182	71250	68333	31	23.20	0.30
ICSH-311	...	6356	2	61	187	94166	88750	31	25.50	0.29
ICSH-319	...	6020	6	63	201	69583	68333	31	24.46	0.26
ICSH-331	...	5212	26	58	171	78333	74583	31	24.22	0.34
ICSH-336	...	5979	7	59	190	83750	80416	31	27.91	0.30
ICSH-109	...	5904	11	59	184	75416	74583	30	21.05	0.26
ICSH-110	...	5272	23	58	168	68750	71250	30	21.35	0.32
ICSH-153	...	5762	13	57	179	72916	71250	30	20.75	0.32
ICSH-159	...	6133	4	56	184	82500	80000	30	23.71	0.28
ICSH-134	...	5975	9	59	196	71250	69583	30	23.99	0.27
ICSH-178	...	5531	19	59	183	76250	69166	30	23.55	0.28
CSH - 5	...	6225	3	60	206	88333	86250	29	25.84	0.31
CSH - 6	...	4625	34	55	170	89166	83333	29	21.18	0.34
FRAMIDA	..	6366	1	59	223	91666	95000	28	28.10	0.28
S-35 (EX. CHECK)		5287	22	58	199	70416	72083	26	24.64	0.30
S-34 (EX. CHECK)		5168	28	60	186	84583	80416	24	23.45	0.23
DAMOUGARI (L. CHECK)		4931	33	58	192	94583	86666	23	22.89	0.27
OVERALL MEAN		5528		58	186	80347	76886	31.7	23.64	0.28
L.S.D. AT 5%		1706.12		5.87	56.31	21459.25	24460.78	8.43	7.00	7.28
C.V. (%)		18.90		6.15	18.50	16.35	19.48	16.29	18.15	14.73

** Significant at 1% level.

Table 11 : TRIAL 3 : West African Sorghum Hybrid Adaptation Trial - 1986.

SOURCE : ICRISAT, OUAGADOUGOU, BURKINA FASO

LOCATION/ENTRIES	MEAN OVER LOCATIONS		
	PLANT STAND AFTER THINNING	DISEASE SCORE (0-5)	INSECT SCORE (0-5)
ICSH - 208	52	3.3	2.0
ICSH - 221	54	4.0	1.3
ICSH - 228	57	2.3	2.3
ICSH - 229	54	2.3	1.3
ICSH - 230	48	2.6	2.6
ICSH - 231	53	2.0	1.6
ICSH - 232	50	1.3	1.0
ICSH - 241	54	3.0	2.6
ICSH - 357	51	2.3	2.6
ICSH - 358	49	2.3	2.0
ICSH - 359	50	3.6	2.0
ICSH - 259	53	2.3	1.3
ICSH - 260	53	2.3	1.6
ICSH - 284	50	2.6	2.6
ICSH - 285	49	3.0	2.3
ICSH - 287	48	2.0	2.0
ICSH - 290	52	3.6	2.3
ICSH - 299	54	1.6	1.6
ICSH - 305	51	2.3	2.6
ICSH - 311	55	3.0	2.0
ICSH - 319	45	1.3	1.3
ICSH - 331	50	2.3	2.6
ICSH - 336	55	2.6	1.3
ICSH - 109	54	2.0	2.3
ICSH - 110	48	2.3	3.0
ICSH - 153	50	2.3	2.3
ICSH - 159	54	1.3	1.6
ICSH - 134	49	2.6	1.6
ICSH - 178	49	2.3	2.0
CSH - 5	51	3.6	2.3
CSH - 6	45	4.6	3.0
FRAMIDA	55	3.6	2.0
S - 35 (EX. CHECK)	49	1.6	1.6
S - 34 (EX. CHECK)	50	1.6	1.3
DAMOUGARI (L. CHECK)	53	3.6	2.3

Table 12 : TRIAL 3 : West African Sorghum Hybrid Adaptation Yield Trial - 1986.

LOCATION : AGRILAGDO, KAREWA

SOURCE : ICRISAT, OUAGADOUGOU, BURKINA-FASO

ENTRIES	GRAIN YIELD (KG/HA)	RANK	DAYS TO 50% FLOWERING	PLANT HEIGHT (CM)
ICSH - 208	2361	12	62	168
ICSH - 221	2777	10	56	175
ICSH - 228	4166	1	58	179
ICSH - 229	2500	11	58	174
ICSH - 230	3472	5	57	182
ICSH - 231	4027	2	57	181
ICSH - 232	1805	14	68	172
ICSH - 241	2500	11	59	182
ICSH - 357	2222	13	56	166
ICSH - 358	2500	11	64	167
ICSH - 359	2916	9	59	191
ICSH - 259	3750	4	60	180
ICSH - 260	3472	5	59	183
ICSH - 263	3750	4	56	178
ICSH - 284	2777	10	65	187
ICSH - 285	2916	9	58	188
ICSH - 287	2916	9	56	174
ICSH - 290	3055	8	55	167
ICSH - 299	3333	6	62	182
ICSH - 305	3055	8	58	201
ICSH - 311	2916	9	65	177
ICSH - 319	3194	7	57	173
ICSH - 331	3194	7	63	187
ICSH - 336	2777	10	60	170
ICSH - 109	3194	7	58	186
ICSH - 110	3333	6	59	157
ICSH - 153	3333	6	61	181
ICSH - 159	3194	7	62	184
ICSH - 134	3472	5	55	174
ICSH - 178	3888	3	61	179
CSH - 5	2777	10	64	176
CSH - 6	3888	3	66	174
FRAMIDA	3055	8	59	187
S-35 (EX. CHECK)	3750	4	58	189
S-34 (EX. CHECK)	3888	3	69	179
DAMOUGARI (L. CHECK)	2916	9	62	177
OVERALL MEAN	3140.4		60.44	178.8
L.S.D. AT 5%	1246.7		9.21	30.40
C.V. (%)	24.38		9.36	10.44

Table 13 : TRIAL 4 : Sorghum Grain Mold Disease Resistance Nursery - 1986.

LOCATION : IRA Sub-Station, TOUBORO

SOURCE : ICRISAT, HYDERABAD, INDIA

ENTRIES	GRAIN** YIELD (KG/HA)	RANK	DAYS TO 50% FLOWE-RING	PANICLE+ GRAIN MOLD RATING SCORES (1-5)	THRESHED++ GRAIN MOLD RATING SCORES (1-5)
IS 715	2245	25	73	1.0	1.0
IS 5959	1975	26	63	1.0	1.0
IS 9470	3375	9	66	1.0	1.0
IS 9484	3225	11	66	1.0	1.0
IS 9487	3825	5	62	1.0	1.0
IS 9493	3125	12	66	1.0	1.0
IS 10692	3012	14	68	1.0	1.0
IS 13885	2875	16	65	1.0	1.0
IS 13958	2525	22	67	1.0	1.0
IS 14375	1500	30	67	1.0	1.0
IS 14380	1237	32	68	1.0	1.0
IS 14384	2675	19	68	1.0	1.0
IS 14387	3025	13	65	1.0	1.0
IS 14390	2475	23	65	1.0	1.0
IS 17141	3437	7	58	1.0	1.0
IS 23585	5262	1	71	1.0	1.0
IS 23599	5100	2	72	1.0	1.0
IS 24995	4600	3	64	1.0	1.0
IS 24996	3825	5	67	1.0	1.0
IS 25008	2737	18	62	1.0	1.0
IS 25025	2937	15	60	1.0	1.0
IS 25038	3587	6	65	1.0	1.0
IS 25070	1750	29	60	1.0	1.0
IS 25074	2525	22	55	1.0	1.0
IS 25075	2400	24	54	1.0	1.0
IS 25084	2850	17	55	1.0	1.0
IS 25085	2526	21	55	1.0	1.0
IS 25103	1425	31	50	1.0	1.0
IS 25104	1762	28	52	1.0	1.0
IS 9326	2625	20	62	1.0	1.0
IS 1548	3387	8	59	1.0	1.0
IS 402	700	33	67	2.0	1.8
SPV 104	1800	27	71	2.3	2.5

TABLE 13 CONT....

S-34 (EX. CHECK)	3275	10	72	1.6	1.9
S-35 (EX. CHECK)	4137	4	62	1.8	1.8
OVERALL MEAN	2849.8		63.48		
L.S.D. AT 5%	1156.26		-		
C.V. (%)	19.96		-		

** Significant at 1% level.

+ PANICLE GRAIN MOLD RATING SCORES

1. No mold visible
2. Scanty superficial mold growth on rachis branches and glumes and upto 10% of grains obviously molded.
3. Considerable mold growth on rachis and glumes and 11 to 25% of grains obviously molded.
4. Considerable mold growth on rachis and glumes, and 26 to 50% of grains obviously molded.
5. Panicle severely molded with more than 50% of grains showing discoloration and mold growth.

++ THRESHED GRAIN MOLD RATING SCORES

1. No mold on grain surface
2. Scanty mold growth and upto 10% grain surface molded.
3. Considerable mold growth and upto 11 to 25% grain surface molded.
4. Considerable mold growth and upto 26 to 50% grain surface molded.
5. Extensive mold growth and more than 50% grain surface molded.

Table 14 : TRIAL 5 : National Sorghum Striga Nursery - 1986

LOCATION : KOGHKOLE, MAROUA

ENTRIES	GRAIN** YIELD (KG/HA)	RANK	STRIGA** COUNT AT HARV./HA	DAYS TO* 50% FLOWERING	PLANT** HEIGHT (CM)	HEAD** COUNT AT HARV./HA	PLANT** COUNT AT HARV./HA	PANICLE** LENGTH (CM)	1000 GRAIN** WEIGHT (GRAMS)
S - 35	3401	3	215627	59	179	52812	54062	23	24.48
S - 34	1823	6	297187	63	143	41250	46250	18	20.85
ICSV - 151	1921	7	555000	70	133	50937	51875	18	15.54
CS - 54	3423	2	325937	60	173	51562	57187	21	27.95
CS - 61	3067	5	429062	65	172	48125	50000	18	27.26
CS - 63	1181	9	714687	70	163	50000	55000	17	17.01
CS - 34	1656	8	943750	69	153	52187	53437	21	22.10
CS - 85	1110	10	590625	63	219	44437	44687	21	15.06
CS - 95	3302	4	26966	68	173	51562	49687	20	27.39
FRAMIDA (R. CHECK)	3894	1	301875	64	164	[illegible]	59375	21	24.36
CK 60B (SUSCEPTIBLE CHECK)	360	11	559361	57	8[illegible]	32545	38062	18	19.20
OVERALL MEAN	2664		566401	64	162	48214	50875	19.8	21.93
L.S.D. AT 5%	1277.10		320817.0	9.5	22.0	11853.0	7231.9	5.3	4.33
C.V. (%)	38.71		[illegible]	10.17	9.0[illegible]	17.02	9.34	18.54	13.66

* Significant at 5% level

** Significant at 1% level

Table 15 : TRIAL 5 : National Sorghum Striga Nursery - 1986

LOCATION : [illegible]

ENTRIES	PLANT STAND AFTER THINNING	AGRONOMIC SCORE (5-0)	LODGING (0-5)
S - 35	43	5	2
S - 34	37	3	1
FRAMIDA	47	3	1
ICSV - 151	41	2	1
CS - 54	46	5	1
CS - 61	40	3	1
CS - 63	44	3	1
CS - 84	43	2	2
CS - 85	36	3	1
CS - 95	40	4	2
CK 60B (SUSCEPTIBLE CHECK)	33	0	0

Table 16 : TRIAL-6 : Multilocation Sorghum Variety Adaptation Yield Trial - 1986 (early duration)

LOCATION : Guiring Research Station, MAROUA (Extreme North Province)

ENTRIES	GRAIN** YIELD (KG/HA)	RANK	DAYS TO** 50% FLOWERING	PLANT** HEIGHT (CM)	HEAD** COUNT AT HARV./HA	PLANT** COUNT AT HARV./HA	PANICLE** LENGTH (CM)	1000 GRAIN** WEIGHT (GRAMS)
SPH - 296	2875	9	[illegible]	168	86145	77708	33	19.09
82 - S - 51	5639	7	55	208	97512	102500	25	20.55
S - 35	6467	4	62	251	73695	76458	26	33.33
CS - 54	6351	5	61	240	74479	75625	26	31.25
CS - 57	6598	3	64	283	104687	104375	30	29.34
CS - 61	6734	1	64	253	85312	77083	27	32.56
ICSV - 1018	5575	8	61	354	131250	133854	25	24.67
IRAT-55 (L. CHECK)	6193	6	64	220	91458	92604	31	31.45
DAMOUGARI (L. CHECK)	6654	2	66	229	105312	105312	14	29.39
OVERALL MEAN	5899		62.3	244.8	95145.2	93946.7	25.5	28.0
L.S.D. AT 5%	615.67		3.34	39.11	7537.13	13176.16	5.96	1.52
C.V. (%)	3.92		3.22	10.20	21.47	12.03	9.95	4.67

** Significant at 1% level.

Table 17 : TRIAL-6 : Multilocation Sorghum Variety Adaptation Yield Trial - 1986 (early duration)

LOCATION : YOLDEO Farmer's Field, YOLDEO (Extreme North)

ENTRIES	GRAIN** YIELD (KG/HA)	RANK	DAYS TO** 50% FLOWERING	PLANT** HEIGHT (CM)	HEAD** COUNT AT HARV./HA	PLANT** COUNT AT HARV./HA	PANICLE** LENGTH (CM)	1000 GRAIN** WEIGHT (GRAMS)
SRN - 29b	[illegible]	9	52	147	64062	78750	33	10.58
82 - S - 51	2682	7	53	152	69270	74062	25	14.57
S - 35	3305	3	58	219	60833	65104	24	21.91
CS - 54	3378	2	55	216	61250	69254	25	22.51
CS - 57	3437	1	60	227	74479	91979	29	21.19
CS - 61	3170	4	59	203	67812	74062	25	20.01
ICSV - 1018	3055	5	59	221	74583	77500	26	20.35
IRAT-55 (L. CHECK)	3010	6	57	173	63542	70937	21	25.71
DANGUGARI (L. CHECK)	1965	8	54	158	65312	65729	13	16.48
OVERALL MEAN	2700		[illegible]	195.5	66806	75150	25.2	19.26
L.S.D. AT 1%	569.3		4.9	33.7	13171.4	11951.9	2.06	3.76
C.V. (%)	10.07		5.95	14.81	15.32	13.64	7.03	12.29

* Significant at 5% level

** Significant at 1% level.

Table 18 : TRIAL [illegible]

LOCATION : [illegible]

ENTRIES	GRAIN** YIELD KG/HA	RANK	DAYS TO** 50% FLOWERING	PLANT** HEIGHT (CM)	HEAD** COUNT AT HARV./HA	PLANT** COUNT AT HARV./HA	PANICLE** LENGTH (CM)	1000 GRAIN** WEIGHT (GRAMS)
SPH - 29?	2180	[illegible]	65	135	64567	60033	23	20.43
82 - S - 51	2515	3	60	134	63339	62083	24	19.17
S - 35	3047	7	[illegible]	162	44375	44062	27	28.83
CS - 54	4210	1	59	176	52241	51875	25	29.33
CS - 57	3657	4	64	210	51354	50937	31	24.12
CS - 61	4192	2	59	161	53541	53125	45	27.99
IOSV - 1018	3473	5	57	266	67916	67708	23	24.59
IRAT-55 (L. CHECK)	3359	6	60	150	58020	57708	25	28.58
DANOUBARI (L. CHECK)	3027	8	60	145	60104	59166	13	25.11
OVERALL MEAN	3419.2		60.5	170.2	57291.6	56328.8	25.5	25.30
L.S.D. AT 5%	871.7		3.45	15.2	10193.6	10020.7	3.35	1.72
C.V. (%)	16.84		3.48	8.19	15.24	15.24	11.30	5.84

** Significant at 1% level.

Table 19 : TRIAL-6 : Multilocation Sorghum Variety Adaptation Yield Trial - 1986 (early duration)

LOCATION : IRA Sub-Station, SOUDOUNDOU (Extreme North Province)

ENTRIES	GRAIN** YIELD (KG/HA)	RANK	DAYS TO** 50% FLOWERING	PLANT** HEIGHT (CM)	HEAD** COUNT AT HARV./HA	PLANT** COUNT AT HARV./HA	PANICLE** LENGTH (CM)	1000 GRAIN** WEIGHT (GRAMS)
SPH - 296	2099	9	65	136	63437	63437	28	19.53
82 - S - 51	3595	6	54	133	59479	59479	25	19.69
S - 35	5656	1	62	153	63958	63958	24	27.75
CS - 54	5072	2	61	197	63020	63020	24	25.34
CS - 57	3793	7	64	227	60937	60937	29	24.93
CS - 61	5013	3	61	197	70833	70833	22	27.46
ICSV - 1016	2954	8	61	267	75104	75104	25	20.58
IRAT-55 (L. CHECK)	3948	5	56	192	63854	63854	20	27.49
DAKOUGARI (L. CHECK)	4244	4	56	177	70000	70000	13	25.70
OVERALL MEAN	4147.8		62.5	191.3	65625	65625	23.7	24.61
L.S.D. AT 5%	597.31		1.49	15.92	6929.2	6929.2	3.57	1.56
C.V. (%)	12.14		1.48	7.14	9.05	9.05	10.31	5.43

** Significant at 1% level.

Table 20 : TRIAL-6 : Multilocation Sorghum Variety Adaptation Yield Trial - 1986 (early duration)

LOCATION : IRA Sub-Station, TCHATIBALI (Extreme North Province)

ENTRIES	GRAIN** YIELD (KG/HA)	RANK	DAYS TO** 50% FLOWERING	PLANT** HEIGHT (CM)	HEAD** COUNT AT HARV./HA	PLANT** COUNT AT HARV./HA	PANICLE** LENGTH (CM)	1000 GRAIN** WEIGHT (GRAMS)
SPH - 296	603	9	70	142	40625	40625	28	14.10
82 - S - 51	2662	1	61	141	48645	48645	24	18.98
S - 35	1494	6	71	175	36250	36250	21	24.75
CS - 54	2080	5	68	202	42500	42500	24	26.14
CS - 57	1454	7	69	183	48437	48437	25	23.16
CS - 61	1429	8	69	157	40416	40416	22	23.43
ICSV - 1018	2360	2	64	253	59479	59479	26	23.01
IRAT-55 (L. CHECK)	2268	3	65	172	47812	47812	21	29.69
DAMOUGARI (L. CHECK)	2244	4	69	177	50625	50625	15	26.46
OVERALL MEAN	1844.3		68.0	178.3	46087.9	46087.9	23.3	23.2
L.S.D. AT 5%	735.84		5.21	34.67	8666.90	8666.90	3.45	2.68
C.V. (%)	34.21		6.79	16.67	16.12	16.12	12.82	9.88

** Significant at 1% level.

Table 21 : TRIAL 6 : Multilocation Sorghum Variety Adaptation Trial - 1986 (early duration)

Plant Stand after Thinning, Score of Disease, Pests and Lodging over various locations.

LOCATIONS	GUIRING			YOLDEO		GUETALE		TCHATIBALI		S O U C O U N D O U			
ENTRIES	PLANT STAND AFTER THIN-NING	DISEASE SCORE (0-5)	INSECT SCORE (0-5)	DISEASE SCORE (0-5)	INSECT SCORE (0-5)	PLANT STAND AFTER THIN-NING	LOD-GING	PLANT STAND AFTER THIN-NING	INSECT SCORE (0-5)	PLANT STAND AFTER THIN-NING	DISEASE SCORE (0-5)	INSECT SCORE (0-5)	LOD-GING
SPH - 296	92	3	3	3	3	108	4	75	2	114	3	3	2
32 - S - 51	101	4	3	3	3	117	4	78	2	112	4	4	2
S - 35	102	2	1	1	0	72	1	73	3	98	2	1	1
CS - 54	93	2	2	2	1	83	2	78	3	103	3	1	2
CS - 57	96	2	2	2	2	60	2	77	3	104	3	2	1
CS - 61	110	2	2	2	2	104	2	76	1	119	2	1	1
ICSV - 1016	100	5	3	4	3	110	5	75	1	121	3	2	1
IRAT - 55 (L. CHECK)	100	5	3	5	4	99	0	78	1	110	3	1	0
DAMOUGARI (L. CHECK)	103	5	3	4	3	107	<1	79	2	106	3	1	0

Table 22 : TRIAL E : Multilocation Sorghum Variety Adaptation Yield Trial - 1985 (early duration)

Mean performance of Grain Yield (Kg/Ha) over various five locations (Extreme North Province).

ENTRIES	LOCATIONS											
	GUIRING	RANK	YOLDEO	RANK	GUETALE	RANK	SOUCOUN-DOU	RANK	TCHATI-BALI	RANK	OVERALL** MEAN	RANK
SFH - 296	2875	9	322	9	2132	9	2099	9	103	9	1614	9
82 - S - 51	5639	7	2693	7	2516	8	3696	6	2662	1	3479	8
S - 35	6467	4	3306	3	3367	7	5856	1	1494	6	4098	3
CS - 54	6351	5	3376	2	4210	1	5573	2	2080	5	4318	1
CS - 57	6595	3	3437	1	3657	4	3783	7	1454	7	3777	4
CS - 61	6734	1	3170	4	4193	2	5013	3	1424	8	4109	2
ICSV - 1018	5573	8	3055	5	3478	5	2954	8	2360	2	3494	7
IRAT - 55 (L. CHECK)	6193	6	3010	6	3369	6	3946	5	2263	3	3762	6
DAMOUGARI (L. CHECK)	6658	2	1905	8	3327	3	4244	4	2244	4	3775	5
OVERALL MEAN	5999.0		2700.0		3419.2		4147.8		1844.3		3602.3	
L.S.D. AT 5%	613.6		569.3		671.7		587.3		735.84		682.76	
C.V. (%)	6.92		18.07		16.84		12.14		34.21		15.20	

** Significant at 1% level.

Table 23 : TRIAL-6 : Multilocation Sorghum Variety Adaptation Yield Trial - 1986 (early duration)

Mean performance of other agronomic characteristics over five locations (Extreme North Province).

ENTRIES	DAYS TO** 50% FLOWERING	PLANT** HEIGHT (CM)	HEAD** COUNT AT HARV./HA	PLANT** COUNT AT HARV./HA	PANICLE** LENGTH (CM)	1000 GRAIN** WEIGHT (GRAMS)
SPH - 296	64	143	63791	64270	31	16.74
82 - S - 51	55	152	67708	67354	25	18.57
S - 35	63	200	57062	57166	24	27.19
CS - 54	61	206	58708	60250	25	27.51
CS - 57	54	226	67979	71333	29	24.57
CS - 61	62	194	63583	63104	24	26.29
ICSV - 1018	60	260	81666	82729	26	22.64
IRAT-55 (L. CHECK)	62	181	64958	66583	21	28.70
DAMOUGARI (L. CHECK)	64	177	70333	72166	13	24.63
OVERALL MEAN	62.23	196.04	66199.1	67439.8	24.64	24.09
L.S.D. AT 5%	3.66	29.13	14686.17	11113.13	3.17	2.27
C.V. (%)	4.72	11.91	17.79	13.21	10.34	7.56

** Significant at 1% level.

Table 24 : TRIAL 6 : Mean performance of grain yield (kg/ha) of various promising lines of sorghum over years and locations in the Semi-Arid Zone of North Cameroon.

ENTRIES	YEARS								OVERALL MEAN	RANK	% INCREASE OVER CHECK VARIETY IRAT - 55
	1983*	RANK	1984***	RANK	1985**	RANK	1986***	RANK			
S - 35	4020	1	2118	1	4758	1	4098	3	3748	1	27.14
CS - 54	-	-	1808	3	4679	2	4316	1	3601	3	22.15
CS - 57	-	-	1684	5	4678	3	3777	4	3379	4	14.62
CS - 61	-	-	2098	2	4611	4	4109	2	3602	2	22.18
36 - 3 (EX. CHECK)	3496	2	1559	6	4281	5	-	-	3109	5	5.46
IRAT-55 (L. CHECK)	2790	13	1209	9	4031	9	3762	6	2948	7	-
DAMOUGARI (L. CHECK)	-	-	1316	8	4262	6	3775	5	3117	6	-
OVERALL MEAN	2840.8		1390.4		4133.0		3602.3		3357.7		
L.S.D. AT 5%	805.1		761.1		301.1		652.7		-		
C.V. (%)	20.44		33.3		14.14		15.20		-		

* Mean over ten locations

** Mean over six locations

*** Mean over five locations.

Table 25 : TRIAL-7 : Multilocation Sorghum Variety Adaptation Yield Trial - 19[illegible] (medium duration).

LOCATION : IRA Sub-Station, BERE (North Province).

ENTRIES	GRAIN** YIELD (KG/HA)	RANK	DAYS TO** 50% FLOWERING	PLANT** HEIGHT (CM)	HEAD** COUNT AT HARV./HA	PLANT** COUNT AT HARV./HA	PANICLE** LENGTH (CM)	1000 GRAIN** WEIGHT (GRAMS)
CS - 60	1267	6	74	172	53250	53250	21	13.49
CS - 63	1460	2	72	166	44250	44250	25	13.15
CS - 84	1083	8	71	135	36125	36125	25	15.47
CS - 85	935	11	72	213	25125	24750	24	13.34
CS - 95	1992	1	67	179	37125	37125	23	19.74
S - 34	943	10	71	147	26500	26500	29	15.15
A13120	1340	5	67	129	30875	23625	23	19.54
M35610	[illegible]	9	71	139	27125	27125	25	18.05
ICSV - 120	673	14	72	208	23250	23250	23	13.21
ICSV - 126	682	13	71	150	21125	21125	24	12.11
ICSV - 151	341	12	70	140	25125	25125	27	10.88
ICSV - 122	1165	7	73	175	26500	26500	26	14.55
HYBRID - 2	345	15	70	161	19000	19000	30	13.17
IS 3547	1403	3	63	215	37875	37875	24	19.21
E 35-1 (EX. CHECK)	1340	4	74	172	50250	50250	18	16.83
OVERALL MEAN	1099.7		70.7	168.1	32233.3	31725.0	24.46	15.19
L.S.D. AT 5%	625.46		2.50	41.07	17044.2	16103.2	3.34	2.04
C.V. (%)	44.89		3.13	19.29	41.74	40.06	10.81	10.63

** Significant at 1% level.

Table 26 : TRIAL-7 : Multilocation Sorghum Variety Adaptation Yield Trial - 1986 (medium duration).

LOCATION : IRA Sub-Station, SANGUERE (North Province).

ENTRIES	GRAIN** YIELD (KG/HA)	RANK	DAYS TO** 50% FLOWERING	PLANT** HEIGHT (CM)	HEAD** COUNT AT HARV./HA	PLANT** COUNT AT HARV./HA	PANICLE** LENGTH (CM)	1000 GRAIN** WEIGHT (GRAMS)
CS - 60	2093	5	78	163	53500	53500	23	19.29
CS - 63	2052	6	70	134	49625	49625	27	18.94
CS - 84	1696	11	69	147	64375	64125	27	22.95
CS - 85	1189	14	77	168	31843	30312	30	19.03
CS - 95	2550	1	65	172	53500	53500	25	35.20
S - 34	2032	7	73	136	40250	40250	33	24.34
A13120	2417	2	66	167	51875	51875	27	33.14
M35610	1333	12	74	154	30125	30125	26	24.99
ICSV - 120	1795	9	75	162	40250	40250	28	23.39
ICSV - 126	1015	15	77	129	19125	18750	25	17.84
ICSV - 151	1760	10	71	113	53500	53500	28	17.21
ICSV - 162	1870	8	70	132	57500	57750	25	20.94
HYBRID - 2	1313	13	67	125	58375	58500	32	21.43
IS 3547	2211	4	65	242	58625	58625	27	27.08
E 35-1 (EX. CHECK)	2233	3	74	169	64500	64375	21	26.35
OVERALL MEAN	1837.2		71.6	155.3	48464.5	46337.5	27.1	23.47
L.S.D. AT 5%	635.5		4.24	38.12	11541.5	11569.6	3.28	2.77
C.V. (%)	27.30		5.10	14.29	15.8	16.92	9.57	9.22

Table 27 : TRIAL-7 : Multilocation Sorghum Variety Adaptation Yield Trial - 1986 (medium duration).

LOCATION : AGRILAGDO, KAFEWA (North Province).

ENTRIES	GRAIN** YIELD (KG/HA)	RANK	DAYS TO** 50% FLOWERING	PLANT** HEIGHT (CM)	HEAD** COUNT AT HARV./HA	PLANT** COUNT AT HARV./HA	PANICLE** LENGTH (CM)	1000 GRAIN** WEIGHT (GRAMS)
CS - 60	2186	5	80	234	60800	67500	22	18.36
CS - 63	2533	2	72	207	58133	56400	27	17.46
CS - 84	1873	10	78	184	42666	61866	[illegible]	21.75
CS - 85	1440	12	63	314	45333	53600	30	16.72
CS - 95	2346	4	69	221	57466	67733	25	25.24
S - 34	2346	4	75	207	49066	52533	32	22.14
A13120	2533	1	68	226	58953	66153	26	26.76
M35610	2000	8	76	215	42933	56800	27	24.06
ICSV - 120	1946	9	77	229	52266	61066	26	20.16
ICSV - 126	1440	12	78	222	40000	44000	24	19.64
ICSV - 151	2400	3	75	209	57466	65600	27	16.42
ICSV - 162	1813	11	74	252	52533	61866	24	20.16
HYBRID - 2	1253	13	70	189	49266	56800	33	18.24
IS 3547	2106	6	70	300	51200	59733	26	22.82
E 35-1 (E). CHECK)	2026	7	76	252	60266	70400	21	22.70
OVERALL MEAN	2017.8		75.2	231.2	52622.2	60408.9	26.9	20.8
L.S.D. AT 5%	672.3		6.13	22.71	12253.71	10244.8	3.15	2.27
C.V. (%)	26.30		6.44	7.75	13.76	13.39	9.24	6.61

* Significant at 5% level
** Significant at 1% level.

Table 28: <u>TRIAL-2</u> : Multilocation Sorghum Variety Adaptation Yield Trial - 1985 (medium duration).

<u>LOCATION</u> : IRA Sub-Station, FIGHOLE (North Province).

ENTRIES	GRAIN** YIELD (KG/HA)	RANK	DAYS TO** 50% FLOWERING	PLANT** HEIGHT (CM)	HEAD** COUNT AT HARV./HA	PLANT** COUNT AT HARV./HA	PANICLE** LENGTH (CM)	1000 GRAIN** WEIGHT (GRAMS)
CS - 60	2428	4	73	181	56125	56625	21	15.58
CS - 63	2042	7	68	161	51875	58000	25	14.07
CS - 64	2776	1	70	159	51750	55875	25	18.48
CS - 85	1323	14	77	234	33250	43750	24	16.57
CS - 95	1875	9	67	217	44250	51375	33	25.58
S - 34	2770	2	71	154	46125	48625	29	23.78
A13120	2371	5	67	182	50750	56500	23	26.57
M35610	1731	11	79	192	32125	43500	25	21.17
ICSV - 120	1658	10	71	165	42625	46375	23	18.69
ICSV - 126	1405	13	71	157	27250	31875	24	17.92
ICSV - 151	2600	3	81	169	59000	58875	27	14.40
ICSV - 162	1951	8	73	186	40375	57125	20	18.75
HYBRID - Z	573	15	72	142	39625	47875	30	13.37
IS 3547	1640	12	60	238	42125	57875	24	23.23
E 35-1 (EX. CHECK)	2325	6	74	222	58000	57750	18	20.95
OVERALL MEAN	1979.5		71.6	185.7	44983.3	51466.7	24.4	19.27
L.S.D. AT 5%	816.34		3.33	49.82	7455.9	7322.5	3.36	2.63
C.V. (%)	32.55		3.67	21.17	13.08	11.23	10.35	10.79

** Significant at 1% level.

Table 29 : TRIAL-7 : Multilocation Sorghum Variety Adaptation Yield Trial - 1995 (medium duration).

LOCATION : IRA Sub-Station, TOUBORO (North Province).

ENTRIES	GRAIN** YIELD (KG/HA)	RANK	DAYS TO** 50% FLOWERING	PLANT** HEIGHT (CM)	HEAD** COUNT AT HARV./HA	PLANT** COUNT AT HARV./HA	PANICLE** LENGTH (CM)	1000 GRAIN** WEIGHT (GRAMS)
CS - 60	2843	9	65	182	59625	69000	22	15.56
CS - 63	3367	4	75	174	60500	67000	27	17.46
CS - 64	3333	2	77	155	?1250	71375	[illegible]	21.94
CS - 85	1350	13	85	221	24875	83000	[illegible]	16.77
CS - 95	2927	7	65	171	51[illegible]	65?75	24	26.27
S - 34	3477	3	74	187	47375	52000	[illegible]	24.21
A13120	3457	5	65	172	50125	59250	[illegible]	26.06
M35610	2827	10	79	179	43750	46625	[illegible]	26.03
ICSV - 120	2195	12	83	174	37000	44500	24	20.90
ICSV - 126	1010	15	86	156	13625	23250	[illegible]	17.94
ICSV - 151	2391	11	79	159	49125	56375	[illegible]	14.68
ICSV - 162	3035	6	76	190	51875	59250	[illegible]	21.31
HYBRID - 2	1145	14	78	141	36250	63125	31	16.63
IS 3547	2849	8	64	237	58000	63500	3?	27.79
E 35-1 (EX. CHECK)	3585	1	78	191	65125	66875	19	24.04
OVERALL MEAN	2637.4		76.5	177.7	48741.6	55366.6	25.5	21.51
L.S.D. AT 5%	736.80		3.46	10.26	11640.3	10501.5	2.65	2.52
C.V. %	22.05		3.56	4.56	16.82	14.84	8.83	9.26

** Significant at 1% level.

Table 30 : TRIAL-7 : Multilocation Sorghum Variety Adaptation Yield Trial - 1986 (medium duration).

LOCATION : IRA Sub-Station, MBANG-BERNI (Adamaoua Province).

ENTRIES	GRAIN** YIELD (KG/HA)	RANK	DAYS TO** 50% FLOWERING	PLANT** HEIGHT (CM)	HEAD** COUNT AT HARV./HA	PLANT** COUNT AT HARV./HA	PANICLE** LENGTH (CM)	1000 GRAIN** WEIGHT (GRAMS)
CS - 60	1831	3	60	126	53500	53500	23	15.51
CS - 63	1743	5	75	137	62500	62500	27	15.60
CS - 84	2551	1	77	131	65375	65375	30	22.90
CS - 85	1084	9	87	137	21500	21500	23	16.83
CS - 95	1067	10	66	133	57000	57000	22	22.75
S - 34	775	12	69	120	37375	37875	26	23.37
A13120	1452	6	67	124	71675	71875	22	22.43
M35610	643	13	80	132	17250	17250	26	27.63
ICSV - 120	779	11	91	123	23875	23875	24	17.57
ICSV - 126	113	15	92	109	4750	4750	22	16.70
ICSV - 151	1744	4	75	132	62875	62875	31	16.17
ICSV - 162	1196	7	77	132	45675	45875	22	16.84
HYBRID - 2	573	14	78	125	27125	27125	28	17.03
IS 3547	1179	8	65	149	64875	64875	24	23.94
E 35-1 (EX. CHECK)	2441	2	76	146	66375	66375	22	22.90
OVERALL MEAN	1278.5		76.6	130.4	45508	45508	25.5	20.1
L.S.D. AT 5%	644.9		3.32	19.0	15131.2	15131.2	3.64	2.24
C.V. (%)	39.32		3.43	11.49	26.24	26.24	11.90	8.79

* Significant at 5% level

** Significant at 1% level.

Table 31 : TRIAL 7 : Multilocation Sorghum Variety Adaptation Trial - II 1986

Plant Stand after Thinning, Score of Disease and Pests over locations.

LOCATIONS	SANSUERE			TOUBORO			FIGNOLE		
ENTRIES	PLANT STAND AFTER THIN-NING	DISEASE SCORE (0-5)	INSECT SCORE (0-5)	PLANT STAND AFTER THIN-NING	DISEASE SCORE (0-5)	INSECT SCORE (0-5)	PLANT STAND AFTER THIN-NING	DISEASE SCORE (0-5)	INSECT SCORE (0-5)
CS - 60	64	3	2	122	3	2	102	3	2
CS - 63	80	3	2	119	3	2	95	3	3
CS - 84	107	3	1	127	3	1	104	3	3
CS - 85	39	3	2	47	2	2	73	2	2
CS - 95	82	4	1	112	3	2	75	3	3
S - 34	68	3	2	96	3	1	88	3	2
A13120	78	4	2	110	4	2	92	4	2
M35610	48	3	2	70	2	1	74	3	3
ICSV - 120	53	3	2	97	2	2	93	3	3
ICSV - 126	31	2	2	40	3	2	55	3	3
ICSV - 151	79	4	2	103	3	2	102	4	3
ICSV - 162	69	3	2	104	3	2	87	4	3
H - ZIMBABWE	93	3	3	109	3	2	94	4	3
IS 3547	100	3	2	118	3	1	98	3	2
E 35-1 (EX. CHECK)	95	3	2	123	3	2	101	3	2

Table 32 : TRIAL 7 : Multilocation Sorghum Variety Adaptation Yield Trial - 1986 (medium duration)
Mean performance of Grain Yield (kg/Ha) over various five locations (North Province).

ENTRIES	LOCATIONS										OVERALL** MEAN	RANK
	SANGUERE	RANK	TOUBORO	RANK	KARENA	RANK	FIGNOLE	RANK	BERE	RANK		
CS - 60	2093	5	2843	9	2186	5	2428	4	1267	6	2163	7
CS - 63	2052	6	3307	4	2533	2	2042	7	1460	2	2279	5
CS - 84	1296	11	3556	2	1893	10	2796	1	1083	8	2205	6
CS - 85	1189	14	1360	13	1440	12	1323	14	935	11	1249	13
CS - 95	2550	1	2927	7	2345	4	1875	9	1992	1	2338	2
S - 34	2032	7	3477	3	2346	4	2770	2	943	10	2314	3
A 13120	2417	2	3057	5	2533	1	2371	5	1340	5	2343	1
M 35610	1333	12	2827	10	2000	8	1731	11	1022	9	1783	11
ICSV - 120	1795	9	2195	12	1946	9	1858	10	673	14	1693	12
ICSV - 126	1015	15	1010	15	1440	12	1405	13	692	13	1110	14
ICSV - 151	1760	10	2390	11	2400	3	2600	3	641	12	1998	9
ICSV - 162	1870	8	3025	6	1813	11	1951	8	1165	7	1964	10
HYBRID - Z	1313	13	1146	14	1253	13	573	15	345	15	926	15
IS 3547	2111	4	2848	8	2106	6	1640	12	1403	3	2042	8
E 35-1 (EX. CHECK)	2228	3	3585	1	2026	7	2325	6	1340	4	2301	4
OVERALL MEAN	1837.2		2637.4		2017.7		1979.5		1099.7		1914.3	
L.S.D. AT 5%	635.5		736.8		672.3		816.3		625.4		1010.2	
C.V. (%)	27.30		22.05		26.30		32.55		44.8		28.90	

** Significant at 1% level.

Table 33 : TRIAL-7 : Multilocation Sorghum Variety Adaptation Yield Trial - 1986 (medium duration).

Mean performance of other agronomic characteristics over five locations (North Province).

ENTRIES	DAYS TO** 50% FLOWERING	PLANT** HEIGHT (CM)	HEAD** COUNT AT HARV./HA	PLANT** COUNT AT HARV./HA	PANICLE** LENGTH (CM)	1000 GRAIN** WEIGHT (GRAMS)
CS - 60	78	126	56450	60395	22	16.65
CS - 63	71	168	52876	55455	26	16.21
CS - 84	73	156	53033	57873	25	20.12
CS - 65	79	230	32085	36082	27	16.48
CS - 95	65	192	49195	55021	24	26.00
S - 34	72	158	41863	43981	31	21.92
A13120	66	175	49711	51476	24	26.82
M35610	76	176	35211	40835	26	23.26
ICSV - 120	75	191	39078	43055	24	19.27
ICSV - 126	76	163	25225	27600	24	17.47
ICSV - 151	75	158	50643	51995	27	14.71
ICSV - 162	73	192	45856	52498	22	19.14
HYBRID - Z	71	152	40703	49060	31	16.58
IS 3547	64	246	49565	55521	25	24.02
E 35-1 (EXOTIC CHECK)	75	205	59628	62330	19	22.17
OVERALL MEAN	73.2	183.6	45409.0	49560.9	25.7	20.06
L.S.D. AT 5%	8.63	41.21	19622.3	18421.3	2.3	4.21
C.V. (%)	4.52	14.36	21.59	18.33	9.85	9.69

** Significant at 1% level.

Table 34 : TRIAL 6 : Mean performance of grain yield (Kg/Ha) of sorghum promising lines over years and locations in the North Province.

ENTRIES	YEARS								OVERALL MEAN	% INCREASE OVER BEST EXOTIC CHECK (35-1)
	1983*	RANK	1984**	RANK	1985***	RANK	1986***	RANK		
S - 34	3150	1	2200	2	2997	1	2314	3	2665	21.69
CS - 63	-	-	2203	1	2452	6	2279	5	2311	5.52
CS - 84	-	-	-	-	2520	5	2205	6	2362	7.85
CS - 60	-	-	1897	4	2607	4	2163	7	2222	1.46
ICSV - 151	-	-	-	-	2719	2	1998	9	2358	7.61
E 35-1 (EX. CHECK)	2510	4	1753	8	2198	15	2301	4	2190	
OVERALL MEAN	2436.3		1729.5		2331.4		1914.3		2351.3	
L.S.D. AT 5%	633.2		501.8		276.8		1010.2		-	
C.V. (%)	18.75		20.2		24.17		28.90		-	

* Mean over three locations

** Mean over four locations

*** Mean over five locations.

Table 35 : Details of advanced generations of sorghum selected during 1986.

LOCATION : Guiring Research Station, MAROUA

GENERATIONS	CROSSES PLANTED	SINGLE PLANTS/ PROGENIES SELECTED
F_1	45	37
F_2	15	110
F_3	317	226
F_4	69	28

Table 36 : TRIAL-1 : Evaluation of Genetic collections of MUSKWARI - 1 (1985 - 1985)

LOCATION : IRA Sub-Station, SALAK, MAROUA

ENTRIES	GRAIN YIELD (KG/HA)	RANK	DAYS TO** 50% FLOWERING AFTER TRANSPLANTING	PLANT** HEIGHT (CM)	PANICLE** COUNT AT HARV./HA	PLANT** COUNT AT HARV./HA	PANICLE** LENGTH (CM)	PANICLE** WIDTH (CM)
SAF - 1	2437	20	64	128	25416	30416	16	16
SAF - 2	3104	8	64	155	32083	29583	17	20
SAF - 6	3304	5	70	148	24583	28750	12	25
SAF - 7	2958	14	65	160	25833	30000	12	18
SAF - 13	3245	6	69	173	30000	33333	19	20
SAF - 14	3916	1	63	145	33750	35833	22	21
SAF - 18	2581	17	49	150	25416	31250	18	19
SAF - 25	2883	12	53	155	30000	28333	16	21
SAF - 40*	3037	10	55	135	35416	37916	10	22
SAF - 44	3062	9	59	140	19166	28750	13	26
SAF - 63	1937	27	63	140	45000	45000	12	27
BOURG - 1	2750	15	61	150	21250	21250	14	19
BOURG - 5	1763	28	45	168	30833	32500	27	16
BOURG - 9	3133	7	67	145	23750	23750	16	24
BOURG - 15	1754	29	80	130	22500	23333	13	22
BOURG - 18	2387	22	64	135	20833	20833	14	23
BOURG - 19	2916	11	65	143	23333	23750	16	21
BOURG - 23	2425	21	57	162	19166	19166	22	21
BOURG - 24	2162	26	55	141	31250	31250	10	21
BOURG - 26	1341	30	74	133	18750	18333	15	24
BOURG - 22	3475	3	55	145	35416	35416	15	24
BOURG - 49	2508	19	44	125	31250	31250	12	22
BOURG - 52	2687	16	59	157	25416	25416	15	23
BOURG - 53	2675	13	64	156	31250	31250	11	25
BOURG - 54	3470	4	67	161	33750	33750	12	23
YAGOUA - 1	3562	2	75	178	22500	22500	16	25
S.D.M. - 1	2525	18	47	58	32916	29166	12	21
BULK - SAF	2295	24	59	170	22916	22916	15	23
BULK - MADJ	2366	23	68	123	16250	16250	10	23
BAMBEY - 6	2208	25	53	105	33333	33333	20	21
SAF - 40* (L. CHECK)	3037	10	55	136	35416	37916	10	22
OVERALL MEAN	2699.93		61.68	144.75	27444.44	28486.11	15.36	22.20
L.S.D. AT 5%	1350.56		10.41	29.05	10054.9	9701.33	4.38	4.48
C.V. (%)	30.61		10.33	12.28	22.42	20.84	17.44	12.37

** Significant at 1% level.

Table 37 : TRIAL-2 : Evaluation of Genetic collections of MUSKWARI - II (1985 - 1986)

LOCATION : IRA Sub-Station, SALAK, MAROUA

ENTRIES	GRAIN** YIELD (KG/HA)	RANK	DAYS TO** 50% FLOWE-RING AFTER TRANSPLAN-TING	PLANT HEIGHT (CM)	PANICLE* COUNT AT HARV./HA	PLANT** COUNT AT HARV./HA	PANICLE** LENGTH (CM)	PANICLE WIDTH (CM)
MADJ - 1	3256	1	71	172	24166	25000	18	21
MADJ - 5	2008	14	72	145	14165	14165	24	21
MADJ - 8	2187	10	64	142	19165	19166	30	22
MADJ - 13	2512	3	64	147	21666	21666	20	25
MADJ - 14	1909	15	69	147	26666	26666	20	22
MADJ - 16	1612	23	72	140	23333	22916	21	20
MADJ - 23	2745	2	79	131	34166	24166	14	21
MADJ - 24	2145	12	76	135	28563	29593	11	19
MADJ - 28	2508	4	75	129	24166	24583	14	20
MADJ - 32	2335	5	77	131	29165	29165	13	21
MADJ - 35	2218	6	65	137	33750	33750	11	22
MADJ - 38	2320	8	57	135	28333	28333	12	20
ADJA - 3	2229	7	72	139	31250	31,250	12	21
ADJA - 7	1837	18	67	131	15416	15833	14	23
ADJA - 17	1854	17	61	120	23750	23750	12	20
ADJA - 34	1691	22	72	103	13750	13750	12	23
ADJA - 36	1741	21	69	144	18333	18333	13	27
ADJA - 37	1350	25	71	120	16666	16666	13	24
SOULK - 1	1854	16	72	150	50416	21250	13	24
SOULK - 3	1808	19	71	156	19583	20000	11	23
SOULK - 7	2216	9	73	135	25000	25416	11	21
SOULK - 12	2081	13	61	111	7500	7500	12	22
SOULY - 1	1454	24	66	109	26250	26250	12	22
SOULY - 2	1766	20	62	124	17916	17916	15	19
MARD - 2	2166	11	62	135	30416	26250	18	20
BAMBEY - 1	762	27	49	120	25416	25416	14	15
BAMBEY - 2	675	28	49	95	20416	21250	16	23
BAMBEY - 3	1062	26	49	101	16666	16250	13	20
BAMBEY - 4	383	30	49	91	19583	19583	17	23
BAMBEY - 5	525	29	49	90	19750	18750	14	14
SAF - 40 (L. CHECK)	3037	10	55	136	35416	37916	10	22
OVERALL MEAN	1840.69		65.68	129.11	23513.88	22486.11	15.28	21.64
L.S.D. AT 5%	797.95		6.99	45.66	17315.96	11727.05	5.94	18.64
C.V. (%)	26.52		6.51	22.11	45.06	31.91	23.78	16.67

* Significant at 5% level

** Significant at 1% level.

Table 38 : Details of advanced generations of Pearl Millet selected during 1986.

LOCATION : Guiring Research Station, MAROUA

GENERATIONS	CROSSES PLANTED	SINGLE PLANTS/ PROGENIES SELECTED
F_4	31	13
ADVANCED GENERATIONS	65	44
UPN SELECTION	100	13

SORGHUM AND MILLET AGRONOMY

1. INTRODUCTION

1.1 SITUATION

Sorghum and pearl millet are the staple cereals in Northern Cameroon, which covers about 160,000 sq. km between 6 and 13° N parallels in the provinces of Adamaoua, North and Extreme North. The combined production of these cereals in 1985-86 was estimated to be 0.49 million tons from 0.53 million ha. The importance of these crops within Northern Cameroon increases from South to North, corresponding closely with decrease in rainfall and shorter growing season. Sorghum is cultivated on light textured soils in the rainy season and on heavier soils (Vertisols) in the post rainy season. The latter crop, a transplanted sorghum (known locally as "muskwari"), is grown on light soils. These cereals are grown in rotation with cotton or groundnut, and often mixed with a small proportion of cowpea or groundnut. Farmers rarely fertilize these crops and yields in the traditional systems are low; sorghum about 780 kg/ha and millet about 585 kg/ha.

Research on food crops in Cameroon was started by IRAT in 1964. Some good work was done on sorghum and millet during 1966-1974, but no work has been done in later years (from 1974 to 1980) by IRA. However, research on cereal crops gained momentum with the initiation of the National Cereals Research and Extension (N.C.R.E.) Project in 1981 with USAID assistance and executed jointly by IRA and IITA. Building on earlier results, there is a need to develop information on optimum land management systems for efficient rainfall utilization, fertilizer management in crop rotations, weed management, pest control, and intercropping. Moreover, improved agronomic practices should also be developed for "muskwari" sorghum and pearl millet which account for about 30% of the annual production of sorghum and millet in Northern Cameroon, but did not receive any attention in phase I (1981-1985) of the project. Therefore, the phase II of the project (1986-1990) recognized the need for a full-time sorghum agronomist.

1.2 CONSTRAINTS FOR SORGHUM AND MILLET PRODUCTION

a) Rainy season sorghum and millet

Though several factors can be identified as limiting sorghum and millet production in Northern Cameroon, the major constraints for which agronomic solutions should be worked out are as follows :

1) Low and erractic rainfall over a short rainy season. This causes intermittent droughts and consequently results in low yields. The problem of moisture deficiency is further compounded by the fact that the soils are light textured, shallow and hold limited quantity of plant available water. Early maturing high yielding cultivars are not available, especially in case of millet. The traditional late cycle cultivars suffer from drought.

2) Low organic matter content of the soils and poor soil fertility resulting in multiple nutrient deficiencies.

3) Insects such as termites, head bugs, and stem borers.

4) Weeds, particularly the parasitic weed Striga hermonthica which infests both sorghum and pearl millet.

5) Limited use of animal traction. The present use of manual labour for most field operations restricts the area that can be cultivated and efficiency of certain field operations.

b) Muskwari sorghum

The following have been identified as constraints for muskwari sorghum production.

1) Limited residual moisture at the end of the rainy season which restricts the crop response to inputs. The residual moisture available at the end of the rainy season is about 150 to 200mm, depending on the water holding capacity of the soil. In view of this limited quantity of water, muskwari sorghum may not respond to improved inputs.

2) Weeds: Muskwari fields are fallowed during the rainy season without any cultivation, so they are heavily infested with weeds. Not only a season is lost but also land clearing for muskwari planting becomes difficult.

3) Manual planting requiring hard labour restricts the area of cultivation. Muskwari is established by transplanting 4 to 5 weeks-old seedlings in 20 to 25cm deep holes made manually with a heavy wooden dibbler. This is a laborious and time consuming operation.

Since sorghum and pearl millet are cultivated primarily by small farmers who do not have any access for costlier inputs, emphasis is given in our research to develop crop management techniques that require less costlier inputs. In view of our limited resources, the first three of the constraints listed for rainy season crops have received our greater attention in 1986-87. We conducted some preliminary studies on muskwari this year.

2. WORK PLAN OUTPUT

The sorghum and millet agronomist arrived in Cameroon just before the commencement of rains on June 1, 1986. He could not participate in the annual planning meeting which was held in March 1986. The cereal agronomist (located in Garoua), who has been conducting some trials on sorghum, had already proposed a work plan for sorghum agronomic research in North Cameroon for the year 1986-87. The sorghum agronomist took the responsibility of executing this approved work plan for the rainy season sorghum at the IRA Center, Maroua. Moreover, based on his discussions with the sorghum breeder and the SAFGRAD's on-farm research agronomist, a few more trials were planned for answering specific questions on the effect of hill planting on sorghum and pearl millet. A few trials were conducted on millet for the first time in the project utilizing an improved variety INMV 8212 that the breeder has identified for the region. A few trials were also conducted on muskwari sorghum. The program had to be on a modest scale due to the fact that the proposals were not discussed and approved in the planning meeting and there was no separate approved budget for the sorghum agronomist for 1986. He had to depend on the resources of the sorghum breeder.

The limited field work facilitated the new scientist to travel and acquaint with the region, familiarize with the functioning of IRA and NCRE, and review the past work on sorghum and prepare a five year work plan for sorghum and millet agronomic research in Northern Cameroon. The following lists the trials conducted at Guiring farm and at Salak in order to solve the constraints identified earlier.

Rainy season crops at Guiring

a) Methods to alleviate moisture stress

1) Effect of tied ridges at different spacings in comparison with normal ridges on sorghum and maize.

2) Response of sorghum to plant population on tied vs normal ridges.

b) Improve fertility status and develop fertilizer recommendation to sorghum

3) Studies on sorghum response to N, P and K when grown in rotation with cotton.

c) Control of insects

4) Effect of Furadan, Mocap and Marshal seed treatment on sorghum.

5) Effect of seed treatment with Marshal on maize.

d) Improved cultural practices

6) Response of an improved sorghum (S 35) to plant density and plants per hill.

7) Comparison of the responses of an improved vs local sorghum to plant population and plants per hill.

8) Response to an improved pearl millet performance under late-sown conditions.

Muskwari Sorghum

1. Performance of rainy season crops and their effect on muskwari sorghum.

2. Effect of date of transplanting on muskwari.

3. Response of muskwari to plant population.

4. Response of muskwari to fertilization.

5. Performance of direct seeded muskwari in comparison with the traditional transplanted crop.

3. GENERAL STATEMENTS

3.1. METHODS

3.1.1. Rainy season crops

The soil type at Guiring is a recent alluvium, fairly flat, deep and light textured. These soils are typical of the area around Maroua and those along the river courses. The long term average annual rainfall is 781mm. Rainfall during 1986 was normal (783mm) and well distributed in July, August and September months. The experimental area in the previous year was used for studies on cotton.

The land was prepared by plowing once, followed by light discing in the beginning of June. Improved genotypes of sorghum (S-35) and pearl millet (INMV 8212) as suggested by the breeder for the region were used. The crops were fertilized with 80 kg N, 40 kg P_2O_5 and 30 kg K_2O per ha, initially with 200 kg/ha of complex fertilizer (15-20-15) at basal and the remaining N through urea top dressed 3 weeks after sowing. A higher dose of fertilizer was used to minimize the soil heterogenity on experimental results. The crops were sown using a higher seed rate at 80cm rows in the first week of July. The stand was thinned to the required population 2 weeks after sowing. This was followed by weeding and ridging by manual labour. Ridges were remade twice during the season. Sorghum matured in 100 days and pearl millet in about 90 days.

3.1.2. Postrainy season crops

The soil at Salak is a Vertisol typical of the muskwari fields with more than 30% clay. Nursery of sorghum was grown on raised beds by seeding at three different dates on 10, 20 and 30 August 1986. This was to obtain nursery of appropriate age for different times of planting in the main field. Immediately after the rains had stopped, the tall grown grass weeds in the main field were cut by matchets and spread over the area. The field was cleared of the material by setting it on fire after 4 to 5 days of drying. About 4 week old seedlings of sorghum were transplanted at a spacing of 1m x 0.75m with 2 plants per hill. For planting, 20 to 25cm deep holes are made with a heavy wooden dibbler, about 200 ml of water is added to the hole and then the seedlings are firmly placed in the hole. Weeds were removed once by working with hoes. The crop was harvested towards the end of January. Specific methods concerning treatments, plot size, statistical layouts, varieties etc. are given under the respective trials.

3.2 ACHIEVEMENTS

All the trials planned for 1986-87 were conducted as per the technical programme and they provided valuable information. Although firm conclusions can not be drawn at this stage as most of the trials were conducted for only one or two years, the information generated would form a basis for recommendations in the near future. However, the results obtained so far from 1984 enable us to formulate recommendations for the improved sorghum S 35 in respect of planting date, plant population, and, to a limited, extent on fertilization.

Little progress was made in respect of training of national staff as there was no Cameroonian counterpart attached to the program. However, a technician who closely worked with the sorghum agronomist gained further field experience in handling sorghum and millet crops and recording of observations.

3.3 Problems

i) There was no separate budget for the sorghum agronomist which restricted the amount of work he could take up.

ii) No equipment was available, particularly for determining soil moisture and soil fertility. Without monitoring of these important parameters, meaningful interpretation of results can not be made.

iii) In the absence of a national counterpart and adequate transport, most of the field work was confined to the IRA research station.

3.4 Opportunities for Professional Development

1. Prepared a brief review of sorghum and millet agronomic research in Northern Cameroon and future research needs. (Mimeo) IRA, Maroua.

2. The sorghum agronomist along with his wife, attended a 6-week French Language training course in France. This improved his acquaintance of French which is the widely used language in North Cameroon.

3. Participated in the FAO/OAU Seminar "Consultation inter-gouvernmentale Pan-Africaine sur le probleme *Striga* en Afrique", 20-25 October 1986 in Maroua.

4. Presented a paper on "Weed management in improved rainfed cropping systems of semi-arid India" to the workshop "Soil, water and crop management systems for rainfed Agriculture in the Sudano-Sahelian zone", 11-16 January 1987, Niamey, Niger.

4. EXPERIMENTAL DETAILS, RESULTS AND DISCUSSION

4.1 RAINY SEASON CROPS

4.1.1 Effect of Tied Ridging

Objective : To examine

a) Whether tied ridging would increase sorghum yields by improved soil moisture conservation as compared to normal ridges,

b) Whether tied ridges require higher plant stand than that for normal ridges, and find out the optimum spacing for tying the ridges.

Methods :

Experiment I combined the first two objectives. This evaluated eight treatments comprising the factorial combinations of tied ridges at 5m interval vs normal ridges, and four plant populations (62500, 83333, 100000 and 125000 plants/ha). The study was conducted in a randomized block design having four replications. The plot size was 6.4 x 15m, of which 3.2 x 8m (4 rows) was harvested for yield. This experiment was sown on 27 June. Experiment II evaluated four treatments where tied ridges made at 2.5m, 5.0m and 7.5m were compared with normal ridges without ties. Results of this study were not considered as they were variable due to soil heterogenity.

R e s u l t s :

The crop grew very well and produced 5 to 6 t/ha (Table 1). Sorghum grown on tied ridges averaged 5816 kg/ha whereas that grown on normal ridges produced 5266 kg/ha, which gives only a 10% advantage for tied ridges over normal ridges. The lack of beneficial effect from tied ridging was because of high and well distributed rainfall during this year. Due to good rainfall, the crop did not experience moisture stress at any stage. In fact, there was temporary water logging in tied ridging treatments during August but that did not cause any ill effect on final yield. There was no response to plant population within the range examined on both the land management systems. However, 83333 plants/ha recorded the maximum yield which confirms the earlier results that this much population was required for high yields in good rainfall years. Higher populations than this density depressed yield primarily due to lodging in some plots.

4.1.2 Response of Sorghum to N, P and K

Objective :

To examine the response of sorghum following fertilized cotton to N, P and K.

Methods :

The study evaluated four levels on N (0, 40, 80 and 120 kg/ha) and two levels each of P_2O_5 and K_2O (0 and 40 kg/ha). The factorial combination of the above levels were evaluated in a randomized block design with four replications. Each plot had six rows of 6m, of which the central four rows were harvested for yield. One half of N and entire dose of P and K, supplied through straight fertilizers, were incorporated just before sowing. The balance of N was top dressed after thinning and weeding.

Results :

The crop did not respond to any of the nutrients, and yields were practically unaffected by different fertilizer treatments (Table 2). The fact that the "nil fertilizer" treatment produced over 5 t/ha indicated that the crop benefited from the high residual fertility accumulated from fertilizers applied to the previous crops. As the site in the past several years was under cropping (mostly under experimentation) with high inputs, the residual fertility was so high that the current fertilization did not make any effect. This experiment points out the limitation of fertilizer trials on research farms where the high initial fertility may result in unrealistic crop responses.

4.1.3 Effect of Hill Planting on Sorghum and Pearl Millet

Objective :

In traditional systems sorghum and millet are sown in hills, leaving 2 to 5 plants/hill. Though this practice may reduce labour time for sowing, it is not known what effect this may have on yields. Two experiments on sorghum and one on millet were conducted to evaluate the effect of hill planting on yields of these crops.

4.1.3.1 Sorghum

Materials :

In Experiment I the effect of planting 1, 2 or 3 plants/hill was evaluated on an improved (S-35) and local (Damougari) sorghum genotypes at two plant populations (62500 and 83333 plants/ha). The study was conducted in a randomized block design with four replications. Each plot had 5 row of 6m, and the 3 central rows were harvested for yield.

Experiment II evaluated five plant populations (41666, 83333, 100000 and 125000 plants/ha) the first one sown only at 1 plant/hill and the remaining four sown at 1 and 2 plants/hill. The nine treatments were examined in a randomized block design having four replications. It was sown on 7 July 1986 and the cultivar used was S-35. The gross plot size was eight rows of 6m, while the net plot was four rows of 6m.

Results :

In the first experiment, the genotype S-35 required resowing as the first sown crop did not come up well, probably because of deeper sowing and partly crusting. However, Damougari sown under similar conditions gave good stand. Obviously S-35 should be planted at a shallower depth as compared to local genotypes.

Because of the delayed establishment, S-35 did not show much advantage over Damougari (Table 3). The higher population (83333 plants/hill) gave only 8% higher yield over that obtained with 62500 plants/ha and the difference between the two treatments was not significant. Sowing different numbers of plants/hill also did not make any difference in the final yield in both the genotypes.

Sorghum (cv. S-35) in the second experiment yielded around 5 t/ha (Table 4). A plant population of 62500 plants/ha recorded an increase of 13% over that produced with 41667 plants/ha. But the difference between these as well as other population treatments was not significant. Similarly, there was no effect of planting more than one plant/hill on yield. In view of the wide plateau in the yield-plant population relationship, the choice of population of sorghum is fairly easy. A population of 62500 to 83333 plants/ha can be suggested, particularly where sorghum is likely to be fertilized and it can conveniently be sown in 2 plants/hill.

4.1.3.2 <u>Pearl Millet</u>

<u>Materials</u> :

Different millet populations, established by sowing different plants/hill, were evaluated in randomized block design with four replications. Millet was planted in two spatial arrangements, 80 x 30cm and 80 x 60cm. At 80 x 30cm, the populations varied from 41667 plants to 166667 plants/ha by having 1, 2, 3, or 4 plants/hill, and at 80 x 60cm spacing the populations varied from 20833 plants to 125000 plants/ha by having 1, 2, 3, 4, or 6 plants/hill (Table 5). Each plot had 7 rows of which 4 rows of 6m were harvested for yield. The crop was fertilized with only 40 kg/ha of nitrogen.

<u>Results</u> :

Millet yield was little affected by eight fold changes in plant population from 20833 to 166667 plants/ha (Table 5). Again, changing the plants/hill at any given population also did not affect yield. Similar yields of millet across such a wide population range was due to the compensating ability of millet through tillering. Thus the harvestable heads per plant at 41667 plants/ha were 12.6 as compared to 3.8 heads/plant at 166667 plants/ha. Similarly at other spacings, heads/plant were 20.4 at a population of 20833 plants/ha as compared to 4.8 heads/plant at 125000 plants/ha. In other words, heads per unit area were similar across all population treatments.

The traditional tall and late maturing cultivars are planted at low population of 10000 hills/ha. The present study showed that there is no advantage of having higher populations even in the case of short statured and short cycle improved genotype.

However, this years' results have to be considered cautiously because of extremely good soil moisture conditions under which the crop was grown.

4.1.4 Control of Termites and Establishment of Good Crop Stand

Objective :

To compare the efficacy of Furadan, Mocap and seed treatment with Marshal in controlling termites and improving the stand establishment of sorghum.

Materials :

An experiment was conducted using Furadan 10% granules at two levels (25kg and 12.5 kg/ha), Mocap at 15 kg/ha and seed treatment with Marshal 25 ST. Furadan was applied either all at sowing, 30 days after sowing (DAS) or split between 1/2 at sowing and 1/2 at 30 DAS. Similarly, the entire quantity of Mocap was either applied at sowing or split 1/2 at sowing and 1/2 at 30 DAS. Marshal is a new chemical for seed treatment against soil insects and some early nematodes. There were two treatments with Marshal-only seed treatment, and seed treatment supplemented with 12.5 kg/ha of Furadan at 30 DAS. The eleven treatments (including control) were evaluated in RBD with four replications (Table 6). The gross plot was 6.4 x 6m (8 rows), but the central 3.2 x 6m (4 rows) was harvested for yield.

Results :

Sorghum in this experiment grew exceedingly well to produce finally very high yields. The control itself yielded about 7 t/ha. The termite infestation was not at damaging level. This was because the soil profile was moist due to good and well distributed rainfall for most part of the crop cycle. It is a common observation that termites are less active in moist conditions. As a result there was no worthwhile beneficial effect due to any of the chemical treatments. Though Furadan 25 kg applied at sowing or in split dose gave an increase of about one ton per ha, the value of this increased produced hardly covers the cost of the chemical. However, there was severe infestation of termites at other locations where this experiment was also conducted. Hence the results of this trial have to be considered in the light of information from other sites as well.

4.1.5 Sorghum and Pearl Millet under delayed condition

Objective :

To compare the performance of sorghum and pearl millet under delayed conditions of sowing. Sowing may be delayed either due to delayed onset of rains or due to the failure of earlier planted crops as a result of break in rainfall.

Materials :

A preliminary experiment was conducted to examine whether sorghum or pearl millet would give better yields under delayed sowing conditions. Improved genotypes of sorghum (S-35) and millet (INMV 8212) were sown later than the generally recommended date for sorghum on 12 July, 23 July and 31 July. The six treatments were examined in a RBD layout with three replications. Adjacent trials where the crops were managed similarly as in this trial provided the yields of these crops for dates earlier than 12 July. They served as control for determining the yield drop due to late sowing.

Results :

Best sorghum yields were obtained from June 27 planting. Yields declined continuously with delay in planting; there was a reduction of 44 kg/ha for each day of delay. However, the crop sown even as late as on 31 July gave 4 t/ha. On the other hand millet yield was unaffected until 23 July and only the last sown crop gave reduced yields. Thus, the improved short cycle sorghum cultivar S-35 has the advantage that it can produce worthwhile yields even under such delayed sowing, unlike the traditional late maturing ones which may yield poorly or fail completely. However, it must be recognized that even the late sown crops gave good yields this year because of good rainfall to the end of September. Similar results may not be obtained in years when the rains end early.

4.2 MUSKWARI SORGHUM

4.2.1 Rainy Season cropping on Vertisols

Objective :

i) To evaluate the feasibility of growing a rainy season crop before the traditional postrainy season muskwari sorghum on Vertisols, and

ii) To evaluate the performance of different rainy season crops.

Methods :

The experiment was conducted at Salak and Yoldeo. The crops examined included maize (Mexican 17E), soybean (S 298, S 320), cowpea (Vita-5, Vya Hout.), pearl millet, and crotalaria. At Salak crops were sown on flat land on July 10, but at Yoldeo they were sown on July 19 after the area was plowed once.

Results :

At both locations, the crops established and grew very well for about two weeks, but from then on they were subjected to prolonged waterlogging due to good rainfall in August/September months. Consequently all crops, except soybean, failed completely. It was interesting to note that soybean could survive waterlogging and produce some pods, though the yield was small. However, the genotypes did not mature by the optimum planting time of muskwari sorghum which is around first week of October.

Despite the failure of rainy season crops, the experiments gave very useful information on the potential of taking two crops on Vertisols in general. Substantial Vertisols area remained waterlogged this year in and around Maroua during August/September months. Since the soils are fairly flat, drainage can be a major constraint for successful rainy season cropping, particularly in good rainfall years such as 1986. Efforts should, therefore, be made to alleviate the drainage problem by suitable land management system such as ridges or broadbed and furrows. The valley bottoms and other low lying areas subjected to prolonged waterlogging may not permit rainy season cropping. Only those areas that are free from drainage or subjected to temporary waterlogging may provide opportunities for rainy season cropping. However, the extent of area in North Cameroon under the above two categories is not known. The rainy season crops/genotypes should also be of short duration types, with 80 to 85 day maturity cycle in order that the following muskwari crop could be planted in time.

4.2.2 Effect of date of Transplanting on Muskwari Sorghum

Objectives :

i) To evaluate the effect of different dates of transplanting on muskwari and suggest optimum time for planting, and

ii) To examine whether genotypes react differently to planting dates.

Methods :

Two genotypes, Safrari-7 and Bourgouri-28 were transplanted on four dates at 15 day intervals beginning September 20. The trial was conducted in a randomized block design having four replications. Each plot had six rows of 7.5m, of which the central four rows were harvested for yield. Spacing used was 1m x 0.75m with 2 plants per hill.

Results :

The two genotypes showed slightly different response to planting date (Table 8). Safrari-7 gave the highest yield from October 5 planting, but it showed significant yield reductions as the planting was delayed beyond this date, so that the November 5 planted crop produced less than half of that from October 5 planting. Bourgouri-28 gave the highest yield from the earliest planting on September 20. Though its yield also decreased with delayed planting, the reductions were not as marked as in the case of Safrari-7. Significant changes were observed due to delayed planting in respect of percentage plants that survived and length of growing cycle. Percent plants that established decreased as the planting was delayed, more in the case of Safrari than with Bourgouri. Late planting also caused early flowering; while the first planted Safrari took 68 days for 50% flowering, the September 20 planted crop flowered in only 53 days. Similarly, the first planted Bourgouri flowered in 78 days, but the latest planted crop flowered in 56 days. Since the final plant stand achieved in late planted crops was still sufficient for normal yields of muskwari sorghum (see results of section 4.2.3.), reduced plant stand may not be the major cause for yield reductions. The yield loss could be attributed to the reduced plant growth as a result of reduced profile moisture with delay in planting, and photoperiodic response of these cold season sorghums to the ensuing short days. The results suggest that early planting immediately after the cessation of rains is the best option for these dry season sorghums.

4.2.3 Response of Muskwari Sorghum to Plant Population

Objective :

To study the response of two muskwari genotypes to plant population.

Methods :

The study was conducted at Salak cv. Safrari-7 and at Yoldeo using cv. Bourgouri-28. Five plant populations (see Table 9) were evaluated in four replications of a randomized block design. The plot size was 6m x 8m, but the four central rows from 4m were harvested for yield. At Salak planting was done on October 10, and harvesting on February 12, 1987. At Yoldeo planting was carried out on October 15 and harvesting on February 7, 1987.

Results :

Yields were not affected by plant population in the range of 10000 to 50000 plants/ha examined in this study at both Salak (Table 9) and Yoldeo (Table 10). Safrari-7 showed slight improvement in its yield with higher than 26667 plants/ha, but treatment differences were not significant. Stalk yields followed similar response pattern as of the grain yield. Obviously, the crop has considerable plasticity in its ability to adjust to plant population changes. The compensation at lower population was by means of higher percentage of plants bearing panicles and by increased panicle weight. For example, the percent plants that produced panicles increased from 58% at 50000 plants/ha to 82% at 10000 plants/ha. Similarly, the panicle weight increased from 67.7 g to 210.5g at the respective above populations (Table 9). Such a wide plasticity of muskwari sorghum to plant population is advantageous in that it permits one to plant a reasonably low population without affecting yield and save planting labour which is a major constraint at the time of planting. Lack of response to plant population even in a good year such as 1986 suggest that there is very little scope for increasing plant population over the generally adopted level of 10000 plants/ha in other years.

4.2.4 Response of Muskwari to Fertilization and Mulching

Objectives :

To examine whether fertilization and mulching would have any positive affect on muskwari yield.

Methods :

Two fertility treatments (40 kg, 40 kg N + 40 kg P_2O_5) in combination with and without mulching and a control were evaluated on Safrari-7 and Bourgouri 28 in a RBD layout over four replications. Fertilizer was applied in a hole made similar for planting 5cm away from the plant, which was closed after placement of the fertilizer. Mulch was created utilizing the straw of tall graminaceous weeds that grew over land during the fallow period. Each plot had five rows of 8.25m at one meter apart, the three central rows were meant for yield estimation. Crop was transplanted on September 28 which matured in about 115 days.

Results :

The crop in this experiment grew very well from the beginning and produced fairly high yields (Table 11). This may be due to better soil moisture from early planting as compared to that for later planted crops in other trials. This further confirms the earlier observation that muskwari should preferably be planted as early as possible after the rains have stopped.

Bourgouri gave slightly higher yields than Safrari, but both the genotypes responded to fertilization similarly. Fertilization improved the yields significantly. While the unfertilized crop averaged 1042 kg/ha, the fertilized crop averaged 1395 kg/ha. There was hardly any difference between the application of nitrogen alone and, nitrogen and phosphorus together. This suggests that the beneficial effect of fertilization was due to nitrogen. Inspite of the generally low phosphorus status of Vertisols, lack of response to P could be due to the difficulty of placing this relatively immobile nutrient within the root zone of muskwari which is planted very deep in the soil. The continuously receding soil moisture in the postrainy season further limits the contact of root system with fertilizer P, if it is not placed much deeper than the planting depth. At the prevailing cost of fertilizer nitrogen (about 100 CFA/Kg N) and market value of sorghum (about 30 CFA/Kg grain), nitrogen application gives a benefit: cost ratio of 2.6 which is reasonably attractive for recommendation. However, these results need further confirmation, especially in the light of initial soil moisture status.

4.2.5 Potential of direct seeding of Muskwari

Objective :

i) To explore the feasibility of direct seeding of muskwari to avoid the laborious manual transplanting, and

ii) To examine whether the direct seeded crop responds to fertilization better than the transplanted crop.

Methods :

This trial was conducted on two soil types, a Vertisol at Salak and a deep Alfisol at Mouda. Three treatments, control, 40 Kg N, and 40 Kg N + 40 Kg P_2O_5 per ha were evaluated on direct seeded and transplanted crops of muskwari sorghum (cvs. Safrari-7 and Bourgouri-28). Treatments were enlarged by adding mulch vs no mulch to the transplanted crop at Salak and they were examined in a separate trial (see section 4.2.4). Weeds were killed by spraying 1.5% Roundup (5 l/ha) in late August and sorghum was sown on September 4 at Mouda and on September 9 at Salak. Transplanting was done at Mouda on September 9 and at Salak on September 28. Fertilizer was planted 5cm away and 5cm deep in the case of direct seeded crop while for the transplanted crop it was applied in a deep hole made adjacent to the planting hole. The trials were conducted in RBD with four replications.

Results :

At Mouda the direct seeded crop established very well and grew as a normal crop. The unfertilized plots initially showed phosphorus deficiency symptoms but the plants recovered with age. However, the crop did not establish well at Salak because of patches of water stagnation. Early vigor of seedlings was poor and there was even stand mortality. This might be due to lack of aeration as the profile of this heavy clay soil was saturated with water in September. The seedlings slowly picked up growth with drying of the soil. Thus, drainage may be a constraint for direct seeding of muskwari on heavy black soils. The direct seeded Bourgouri tillered profusely but considering the limited quantity of soil moisture, the tillers were removed and only the main stem was allowed to maturity. Absence of tillering on Safrari suggests that it is a genetic character. The direct seeded and transplanted crops flowered and matured around the same time. Between genotypes, Safrari was about 10 days earlier than Bourgouri. As there was no other sorghum in Mouda there was severe bird damage on the yellow grained Safrari, so the results of this variety were highly variable (Table 12). However, there was no damage on this variety at Salak and on the red grained Bourgouri at both sites.

The results of Bourgouri at Mouda indicate that the direct seeded crop could yield as good as the transplanted crop (Table 12). But at Salak the direct seeded crop did not perform as well as the transplanted crop (Table 11 and 12). Yield of direct seeded Safrari was only 50% of the transplanted crop while the same with Bourgouri was at least 78%. Bourgouri, but for the undesirable character of tillering, appears to be adapted better for direct seeding than Safrari. Though there was no significant effect of fertilization, the combined application of nitrogen and phosphorus showed an increase of about 300 kg grain per ha at both locations. The occurrence of P deficiency and lack of any response to N imply that the beneficial effect of fertilization may primarily be due to phosphorus.

The results of these studies should be treated as preliminary and it is difficult to evaluate the potential of direct seeding of muskwari at this stage. However, this needs to be explored further in conjunction with rainy season cropping.

4.3 Conclusions/Recommendations

As most of the trials were initiated only recently, firm recommendations may not be possible at this stage. However, the following suggestions emerge from this year's studies.

1. A plant population of 62500 plants/ha should be used for the local and improved sorghum genotypes. This can be achieved by sowing sorghum at a spacing of 80 x 40cm and leaving 2 plants/hill.

2. Pearl millet can be planted at much wider spacing. A density of about 40000 plants which can be obtained by 80 x 60cm and 2 plants/hill is recommended.

3. Sorghum that follows fertilized cotton is unlikely to provide economic responses to fertilization. However, this needs further verification on diverse soil types.

4. The short duration and high yielding sorghums such as S 35 can be planted as late as July end with economically viable yields.

5. Muskwari sorghum should be planted as early as possible immediately after the end of rains.

6. Direct seeding of muskwari sorghum seems to be possible on somewhat lighter soils. But its scope needs to be considered in the context of rainy season cropping.

7. Response of muskwari sorghum to plant population beyond the normal 10000 plants/ha is rather small. However, a density of 20000 plants/ha at 1 x 1m with 2 plants per hill may be suggested as a safe level of ensuring the required stand for potential yields.

TABLE 1

EFFECT OF NORMAL vs TIED RIDGES AND PLANT POPULATION ON SORGHUM, GUIRING 1986

Plant Population (Plants/ha)	Land Management (kg/ha)		
	Normal ridges	Tied ridges	Mean
62500	5442	5248	5345
83333	5615	6567	6091
104200	5060	5640	5350
125000	4948	5808	5378
Mean	5266	5816	
SE	± 198		± 278
CV (%)	14.2		

TABLE 2

RESPONSE OF SORGHUM FOLLOWING COTTON TO N, P_2O_5 AND K_2O, GUIRING 1986

N (kg/ha)	P_2O_5 0		40		Mean
	K_2O 0	40	0	40	
0	5357	5382	4911	5030	5170
40	5514	5610	4408	5365	5224
80	5580	5019	5378	5450	5356
120	5481	5550	5377	5767	5544
Mean	5483	5390	5019	5408	
Mean (P_2O_5)	5436		5211		
SE	± 247				

TABLE 3

EFFECT OF PLANT POPULATION AND PLANTS/HILL ON SORGHUM CULTIVARS DAMOUGARI AND S-35

POPULATION (plants/ha)	PLANTS/HILL	DAMOUGARI	S-35	MEAN
	1	3338	3526	3432
62500	2	3437	3185	3311
	3	3072	3635	3354
	Mean	3282	3448	3366
	1	3157	3500	3329
83333	2	3435	4131	3783
	3	3587	4125	3856
	Mean	3337	3683	3656
MEAN		3310	3566	
SE (variety/population	± 119		SE (general) ± 290	

TABLE 4

EFFECT OF PLANT POPULATION AND PLANTS PER HILL ON YIELD OF SORGHUM (CV.S-35),GUIRING 86

PLANT POPULATION (PLANTS/HA)	1 PLANT/HILL	(kg/ha)	2 PLANTS/HILL	MEAN
41667	4730		-	-
62500	5360		5280	5320
83333	4961		5183	5072
104200	5142		5105	5124
125000	4626		5086	4856
MEAN	5022		5163	
SE		± 246		
CV (%)		8.4		

TABLE 5

EFFECT OF PLANT POPULATION ON TILLERING AND YIELD OF PEARL MILLET (cv.INMV 8212), GUIRING 198

SPACING (cm)	PLANTS PER HILL	DENSITY (plants/ha)	HARVESTABLE HEADS (n°) per hill.	per plant	YIELD (kg/ha)
	1	41667	12.6	12.6	2859
	2	83333	13.2	6.6	2892
80 x 30	3	125000	14.7	4.9	3035
	4	166667	15.0	3.8	2692
					2870
	1	20833	20.4	20.4	2848
	2	41667	24.4	12.1	3290
	3	62500	22.2	7.4	3022
80 x 60	4	83333	23.6	5.9	2773
	6	125000	28.9	4.8	2903
					2967
SE					± 157
CV (%)					10.7

TABLE 6

RESPONSE OF SORGHUM TO FURADAN, MOCAP AND MARSHAL, GUIRING, 1986

TREATMENT	YIELD (kg/ha)	INCREASE OVER CONTROL (%)	(kg/ha)
CONTROL	6933	-	-
F 25	7951	+ 15	+ 1018
F 25 (30 DAP)	6701	- 3	- 232
F 25 (1/2+1/2 30 DAP)	8210	+ 18	+ 1277
F 12.5	6932	0	0
F 12.5 (30 DAP)	6868	- 1	- 65
F 12.5 (1/2+1/2 30 DAP)	7162	+ 3	+ 229
M 15	6645	- 4	- 288
M 15 (1/2+1/2 30 DAP)	7174	+ 3	+ 241
M S T	7622	+ 10	+ 689
M S T + F12.5 (30 DAP)	7524	+ 9	+ 591
SE	± 454	CV (%) = 12.6	

F-10% FURADAN, M-MOCAP, MST-MARSHAL SEED TREATMENT

DAP - DAYS AFTER PLANTING

TABLE 7

EFFECT OF DIFFERENT DATES OF SOWING ON SORGHUM (cv. S-35) AND PEARLMILLET (cv. INMV 8212) GUIRING, 1986

SOWING DATE	SORGHUM		PEARLMILLET	
	YIELD (kg/ha)	CHANGE IN YIELD (kg/day)	YIELD (kg/ha)	CHANGE IN YIELD (kg/day)
*27 JUNE	5540	-	-	-
* 5 JULY	5224	- 40	2870	- 8
12 JULY	4988	- 37	2647	- 34
23 JULY	4315	- 45	3073	-
31 JULY	4036	- 44	2040	- 129
SE	± 270		± 270	
CV (%)	9.6			

* Yields from adjacent experiments with similar management.

TABLE 8 EFFECT OF DATE OF TRANSPLANTING ON MUSKWARI SORGHUM, 1986-87

DATE OF PLANTING	PLANT STAND AT HARVEST		STAND WITH PANICLES		PANICLE WEIGHT		GRAIN YIELD	
	SAF-7	BOURG-28	SAF-7	BOURG-28	SAF-7	BOURG-28	SAF-7	BOURG-28
	(PLANTS/HA)		(%)		(G)		(KG/HA)	
20 SEPT.	24666	26666	86	86	62	81	1036	1490
5 OCT.	26000	25000	95	93	62	69	1260	1173
20 OCT.	14000	25000	88	85	73	66	743	1110
5 NOV.	13666	18000	83	83	57	67	520	783
MEAN	19583	23666	88.0	86.7	63.5	70.7	890	1139
SEM ±	890		-		6.7		96	
CV (%)	8.2		-		20.0		18.8	

TABLE 9 RESPONSE OF MUSKWARI SORGHUM (CV. SAFRARI-7) TO PLANT POPULATION, SALAK, 1986-87.

SPACING* (M)	PLANT POPULATION	STAND AT HARVEST	PANICLE NUMBER	PANICLE WEIGHT	GRAIN YIELD	STALK YIELD
	(NUMBER PER HA)			(G)	(KG/HA)	
1 x 2	10000	8194	8194	210.5	1350	1450
1 x 1	20000	15611	14166	126.3	1394	1376
1 x 0.75	26667	17638	16250	124.3	1575	1397
1 x 0.5	40000	30472	22027	88.5	1580	1564
1 x 0.4	50000	38416	29166	67.7	1572	1340
SEM ±	-	-	-	13.3	100	130
CV (%)	-	-	-	21.5	13.4	18.3

* TWO PLANTS WERE PLANTED IN EACH HILL

TABLE 10 RESPONSE OF MUSKWARI SORGHUM (CV.BOURGOURI-28) TO PLANT POPULATION, YOLDEO, 1986-87.

SPACING* (M)	PLANT POPULATION	STAND AT HARVEST	PANICLE NUMBER	PANICLE WEIGHT	GRAIN YIELD	STALK YIELD
	(NUMBER PER HA)			(G)	(KG/HA)	
1 x 2	10000	10000	10000	177.0	1389	1720
1 x 1	20000	18833	18194	101.0	1430	1722
1 x 0.75	26667	24444	23111	85.7	1483	2087
1 x 0.5	40000	37638	31250	62.0	1444	1639
1 x 0.4	50000	49444	35750	53.5	1475	1847
SEM ±	-	-	-	4.2	69	88
CV (%)	-	-	-	8.7	9.6	9.8

* TWO PLANTS WERE PLANTED IN EACH HILL

TABLE 11 RESPONSE OF MUSKWARI SORGHUM TO FERTILIZATION SALAK, 1986-87

FERTILIZER (KG/HA)	GRAIN YIELD (KG/HA		STALK YIELD (KG/HA	
	SAF-7	BOURG.-28	SAF.-7	BOURG.-28
0	1062	1030	1798	1516
40N	1240	1499	2080	1967
40N-40 P_2O_5	1272	1544	2020	1846
40N MULCH	1365	1297	2133	2250
40N-40 P_2O_5 MULCH	1434	1507	2444	2020
MEAN	1275	1375	2091	1940
SEM ±	148		222	
CV (%)	22.5		22.0	

'F TEST' SIGNIFICANT ONLY FOR THE COMPARISON OF FERTILIZER VS NO FERTILIZER IN BOTH PARAMETERS.

TABLE 12 COMPARISON OF THE PERFORMANCE OF DIRECT SEEDED VS TRANSPLANTED MUSKWARI SORGHUM AT THREE DIFFERENT FERTILITY LEVELS, 1986-87.

TREATMENT (KG/HA)	MOUDA: DIRECT SEEDING	MOUDA: TRANS-PLANTING	SALAK (KG/HA): DIRECT SEEDING GRAIN	SALAK (KG/HA): DIRECT SEEDING STALK
SAFRARI-7				
0	544	370	743	1573
40N	454	750	637	1340
40N-40 P_2O_5	233	420	677	1597
MEAN	414	513	685	1503
BOURGOURI-28				
0	1050	841	970	2106
40N	1075	942	1000	1957
40N-40 P_2O_5	1358	1158	1260	2350
	1161	980	1076	2137
SEM ±	185	272	85	193
CV (%)	47.0	73.2	19.4	21.2

RICE BREEDING

INTRODUCTION

Rice is an important crop in Cameroon and is fast gaining popularity as a major food crop both in the urban and rural areas. Eighty-two percent of the total production is by government initiated irrigated rice development projects and the remaining 18 percent is by traditional cultivation. Due to the intensive nature of production by the irrigated rice development projects, the need for improved varieties and cultural practices is very great. As a result, research is geared to solve the problems in a practical manner and for this purpose, research is conducted mostly at the production sites to solve specific problems.

The three main irrigated rice development projects in the country and their respective targeted areas of cultivation are as follows :

- Society for the Expansion and Modernization of Rice in Yagoua. (SEMRY) - 10,000 hectares.
- Upper Noun Valley Development Authority (UNVDA) - 3,000 hectares.
- Society for the Development of Rice in Mbo Plain (SODERIM) 2,500 hectares.

The estimated total production of rice in 1985/86 was 101,000 metric tons. SEMRY, based in the extreme north province where the constraints are few and with facilities for double cropping, produces the most, UNVDA and SODERIM which are situated in the mid-altitude regions of north west and western provinces also contributed to the total production.

Apart from the large irrigated rice development projects, rice is also grown by small farmers under traditional cultivation. Efforts were made to reach them with the new technologies in collaboration with the Testing and Liaison Unit of the NCRE Project and with extension agencies of these areas.

Limited support was also extended to the research conducted in the North Province, where Karewa Experimental Farm is about to pioneer the cultivation of irrigated rice in large areas.

Though the priority is for irrigated rice, upland rice research was also conducted in the North West Province, in order to support local farmers and have the technology available, when required, by the development projects of the country.

C O N S T R A I N T S

The varietal constraints to increased production for both irrigated and upland rice at UNVDA in Ndop Plain and SODERIM in Mbo Plain are as follows :

GENERAL

- High and stable yields
- Resistance to diseases
  - . Leaf blast
  - . Neck blast
- Tolerance to low temperatures
- Good grain quality (long translucent grain with good keeping quality).
- Photosynthetically efficient under low light intensity.
- Resistance to lodging.
- High milling recovery.
- Short/medium duration.
- Response to fertilizers.

SPECIFIC TO NDOP PLAIN - IRRIGATED

- Resistance to sheath rot disease.
- Resistance to grain discoloration.

SPECIFIC TO NDOP PLAIN - UPLAND

- Resistance to leaf scald disease.
- Resistance to brown spot disease.
- Early duration (90-120 days).
- Early seedling vigour.

M E T H O D O L O G Y

The methodology adopted was generally similar to that of previous years. On the short-term, introductions of fixed and elite lines adapted to African conditions were brought in and screened at the different sites for suitability as varieties per se or as donor parents. On the medium term, segregating early generation materials from selected parents were screened for suitable material. On the long-term, the hybridization program was continued with adapted parents to develop superior genotypes for the specific ecologies of the country.

In order to screen and test the materials for suitability, a number of trials were conducted at each location. The number of lines, replications and plot sizes varied according to the precision that was necessary in each trial.

The observational nurseries, with large number of lines, were evaluated in two to four row plots of 5 metres length. The plots were also unreplicated. All yield trials were conducted in randomized complete block designs with 3 to 4 replications, each plot being 3m x 5m. The number of entries for these yield trials varied from 25-15 entries. The elite varietal trials comprised 6-7 promising entries with plot sizes of 200 m^2 and were unreplicated.

A number of farmers' field rice varietal trials were conducted in collaboration with the Testing and Liaison Unit of the NCRE Project and directly with Extension agencies in small farmer areas. The number of entries were limited to four or five promising lines and the plot sizes were generally 200-300 m^2 for each entry per farmer. These trials should give a fair indication of the promising entries in the farmers' fields.

Under irrigated conditions, 2 to 3 seedlings were transplanted 25cm x 25cm at 3-4 weeks after sowing the seed. At Mbo Plain, N and K_2O were applied at the rate of 60 kg/ha in 3 splits. P_2O_5 was applied at the rate of 120 kg/ha as a basal dose. At Ndop Plain N was applied at the rate of 50 kg/ha in 3 splits. P_2O_5 and K_2O were each applied at 30 kg/ha as basal doses.

Under rainfed upland conditions at Ndop Plain, the seeds were drilled in rows 25cm apart, at the rate of 70 kg/ha. N was applied at the rate of 60 kg/ha in 3 splits. P_2O_5 and K_2O were applied as basal doses at the rate of 40 kg/ha. Ronstar at the rate of 4 l/ha was applied as a pre-emergence herbicide, one day after sowing. At Mbo Plain, no upland trials were conducted in 1985-86 due to budgetary constraints.

Weeding at all the locations and in each ecology was carried out manually whenever necessary.

OUTPUT (RESULTS)

During the year 1986-87, a total number of 29 trials were conducted at Mbo Plain and Ndop Plain under both irrigated and upland conditions. Greater emphasis was placed on the irrigated ecology as this was more important at these two locations.

In the past few years, a number of lines superior to that of the existing cultivars were identified and confirmed at these two sites. This year, the search continued to improve on the new lines, through introductions and hybridization with greater selection pressure, for characteristics such as resistance to prevalent diseases, tolerance to cooler temperatures and better grain quality.

MBO PLAIN

Irrigated :

One hundred elite lines from different programs in Africa-coordinated by IRTP-Africa - were screened on the basis of resistance to prevalent diseases and desirable agronomic traits. 24 lines were selected for further testing.

In the four early duration trials conducted during the year a number of entries showed promise. They are YR 1805-17-3-2 (6234 kg/ha), P2231-F4-138-1B (5238 kg/ha), P3059 F4-87-2-1B (4845 kg/ha), BR14-83-127-3 (5018 kg/ha), P1035-5-6-1-1-M (4932 kg/ha) and P1377-1-15M-4-1M-1 (4820 kg/ha). These were not significantly different from the improved check, ITA 222 (4901 kg/ha), in yield, but the grain quality of most of these entries appeared to be superior.

In the four medium duration trials conducted P881-77-6-B-CR-6-7 (6350 kg/ha) Bouake 189 (5881 kg/ha), Nang Ng Hiep 75-5 (6213 kg/ha), 2B2.13 (5293 kg/ha), P1274-6-8M-1-3M-1 (4913 kg/ha) M576-146-1 (5136 kg/ha) and IR 25620-68-3-2-1-3 (5091 kg/ha) were high yielding. Nang Ng Hiep 75-5 and 2B.13 did not possess good grain quality. The others were comparable to CICA 8 and ITA 222 which were used as improved checks.

In the elite varietal trial conducted this year at 3 dates of sowing Nang Ng Hiep 75 75-5 yielded well (5302 kg/ha) followed by ITA 222 (5131 kg/ha), ITA 233 (5009 kg/ha) and CISADANE (4910 kg/ha). The grain quality of Nang Ng Hiep 75-5 needs to be improved.

The hybridization work was continued during the year and in some crosses F2 seed has been obtained. These will be tested in the coming year, and the program continued.

NDOP PLAIN

Irrigated :

174 entries specifically introduced for cold-tolerant areas were screened. 18 selections were obtained for further testing on the basis of tolerance to cold, resistance to diseases, desirable agronomic characteristics and quality of grain.

In the three variety trials conducted for this location B2983G-SR-43-7 (3045 kg/ha) B2983G-SR-2-9 (3016 kg/ha), B3381F-SR-95-25 (3757 kg/ha) CISADANE (3658 kg/ha), B2161-C-M-57-1-3-1 (3695 kg/ha) RNR 29692 (3715 kg/ha) were found to be high yielding. The grain quality of most of these lines are fair.

In the elite varietal trial conducted on an area of 200 m^2 for each entry, RNR 29692 was the highest yielding (4345 kg/ha) followed by B2161C-MR-57-1-3 (4145 kg/ha) and R2938-SR-51-1-2-1 (3265 kg/ha), IR 7167-33-2-3, the improved variety, recently released for cultivation yielded 3180 kg/ha.

Generally the grain yield in all the trials at this location were lower as they were affected by a hailstorm just after flowering.

UPLAND

250 entries from IRTP-Africa were screened and 51 entries were selected on the basis of resistance to diseases, desirable agronomic traits and tolerance to cooler temperatures. These will be tested in 1987-1988.

In the two varietal trials carried-out Seratus Malam Mutant was the highest yielder (3640 kg/ha) followed by B4023 d-tb-33 (3371 kg/ha) IRAT 104 (3000 kg/ha) and M18 (2821 kg/ha). The local check, IAC 25 yielded 1263 kg/ha. IAC 25 is a shorter duration variety compared to the others.

MULTI-LOCATIONAL TRIALS

In the irrigated trials conducted in the farmers fields of Tingo - Menchum Valley, in collaboration with the Village Community Extension Project, Bafut, ITA 222 continued to perform well followed by CISADANE, CICA 8 and ITA 212. It appears that farmers have indicated preferences for these improved lines.

In the upland trials conducted at Babungo-IRA ISA 6 was the highest yielder (4017 kg/ha) followed by IRAT 112 (3865 kg/ha), IRAT 109 (3520 kg/ha) and the local check M55 (3515 kg/ha).

In Befang-IRA, too, where the upland trial was conducted ISA 6 was the highest yielder (4766 kg/ha) followed by ITA 208 (4454 kg/ha), IRAT 112 (4188 kg/ha) and the local check (3781 kg/ha).

HYBRIDIZATION

The hybridization work continued during this year and in some crosses, F2 seed has been obtained. These will be tested during the coming year in the field. Efforts have been made to strengthen this aspect of our program in order to provide materials for the different ecologies of rice cultivation in the country.

ACHIEVEMENTS

Irrigated

Mbo Plain

It has been confirmed that varieties such as ITA 222, CISADANE and Nang Ng Hiep 75-5 are stable over the years and could yield over 5 tons/hectare in the second season at Mbo Plain. Nang Ng Hiep 75-5 and CISADANE are fairly resistant and ITA 222 is moderately resistant to the disease blast. The grain quality of ITA 222 and CISADANE are acceptable while that of Nang Ng Hiep 75-5 needs to be improved. These lines are now in the seed multiplication stage at this site.

It is also encouraging to note that a few new entries such as P881-77-6-B-CR-6-7, P1274-6-8M-1-3M-1 in the medium duration category and YR1805-17-3-2, P2231-F4-138-1B, BR14-83-127-3 in the early duration category are showing promise in this location. These will be tested further to test their stability.

Ndop Plain

The recently identified variety IR 7167-2-3 was released for general cultivation by the rice development authority UNVDA this year. Through it yielded well in the experimental plots this year too, there is a another entry showing equal greater promise. RNR 29692 has yielded well and shown stability over the past few years. The grain quality of RNR 29692 is similar to that of IR 7167-33-2-3 medium long grain and hence need to be improved.

New entries such as B 2983G-SR-43-7, B 2983G-SR-2-9 and B 3381F-SR-95-25 appear to be promising at this location. These need to be tested further.

Tingo-Menchum Valley

In this valley where small farmers cultivate rice, ITA 222, CISADANE, CICA 8 and ITA 212 have performed well and it appears that the farmers have indicated a preference for these improved lines.

Upland

In the upland trials conducted in the North West Province, ISA 6 appears to be the most promising followed by IRAT 112, IRAT 109 and ITA 208. The grain quality of these varieties are acceptable to the farmers.

Problems

- Vehicles continued to break-down and the replacements did not arrive during the 1986-87 cropping season.
- Machinery and equipment ordered a few years earlier had not arrived and this hampered the work.
- Budgetary constraints imposed on the work had its effect in the smooth running of our trials.

Table 1.

PERFORMANCE OF PROMISING SELECTIONS UNDER IRRIGATED CONDITIONS OF MBO PLAIN AT THREE DATES OF PLANTING IN 1986.

SINGLE PLOTS : 200 M2

GENOTYPE	GRAIN YIELD (KG/HA)		
	IST DATE	2ND DATE	3RD DATE
ITA 222	5074	5808	4513
NANG NG HIEP 75-5	5020	5706	5182
ITA 233	4961	5182	4886
ITA 212	4793	2645	3708
CISADANE	4551	5295	4886
CICA 8	4162	3136	2802
IR 3273-339-2-5	3163	3298	3945
MEAN	4532	4438	4275

The above promising selections were each planted on 200 m2 each at 3 different planting dates to show its versatability in different environments. Nang Ng Hiep 75-5 was the most stable followed by ITA 222, ITA 233 and CISADANE(Table 1).

ITA 212 and CICA 8 were affected most and were found to be susceptible to the disease blast in the later plantings.

.../...

Table 2.

PERFORMANCE OF PROMISING SELECTIONS UNDER IRRIGATED CONDITIONS AT MBO PLAIN.

GENOTYPE	1982 - 1985		1986		OVERALL
	NUMBER OF TRIALS	AVERAGE YIELD (KG/HA	NUMBER OF TRIALS	AVERAGE YIELD (KG/HA)	AVERAGE YIELD (KG/HA)
ITA 222	8	5508	7	4815	5184
ITA 212	9	5313	3	3715	4913
CICA 8	9	5101	3	3367	4667
CISADANE	5	4977	3	4910	4952
IR 3273-339-2-5	13	4796	3	3469	4547
TAINAN 5	14	4189	-	-	4189
NANG NG HIEP 75-5	-	-	5	5426	5426

Table 2 gives the performance of promising selections over the years 1982-1986 under irrigated conditions at Mbo plain.

Though some of these selections are only moderately resistant to leaf blast disease, they still give grain yields nearing 5t/ha. ITA 222, ITA 212, CICA 8 and IR 3273-339-2-5 are now in the seed multiplication stage with the parastatal body.

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Table 3.

PERFORMANCE OF PROMISING SELECTIONS UNDER IRRIGATED CONDITIONS AT NDOP PLAIN.

GENOTYPE	1982 - 1985		1986		OVERALL AVERAGE YIELD (KG/HA)
	NUMBER OF TRIALS	AVERAGE YIELD (KG/HA)	NUMBER OF TRIALS	AVERAGE YIELD (KG/HA)	
RNR 29692	5	5808	3	3815	5060
B21CIC-MR-57-1-3-1	7	5742	3	3779	5153
B29838-SR-51-1-2-1	7	5503	2	3189	4989
IR7167-33-2-3	12	5490	4	2969	4860
IR 2061-522-6-9	7	4825	2	2979	4415
TAINAN 5 (CHECK)	11	4100	4	2452	3660

Table 3. shows the performance of promising selections under irrigated conditions at Ndop plain over the years 1982-86. Though IR 7167-33-2-3 was not the highest yielder, its overall performance is good. RNR 29692 is similar to that of IR 7167-33-2-3 but yields better. Though the two Indonesia. lines(B series) yield well, the grains shatter and this needs to be improved.

.../...

Table 4.

PERFORMANCE OF PROMISING SELECTIONS IN MULTI-LOCATIONAL UPLAND TRIALS.

BABUNGO - 1140 M.

GENOTYPE	PLANT HEIGHT (CMS)	DAYS TO 50% FL. (DAS)	GRAIN YIELD(KG/HA) 1984	1985	1986	AVERAGE
IRAT 109	74	108	3780	4375	3520	3892
IRAT 112	76	102	4250	3156	3865	3757
M55(CHECK)	102	125	3670	4031	3515	3739
ITA 208	86	123	3220	4000	3394	3538
ROK 16	119	125	2310	3672	2816	2932

FERTILIZERS: N- 60 KG/HA, P_2O_5 - 40 KG/HA, K_2O - 40 KG/HA.

BEIFANG - 700 m.

GENOTYPE	PLANT HEIGHT (CM)	DAYS TO 50% FL. (DAS)	GRAIN YIELD (KG/HA) 1984	1985	1986	AVERAGE
ITA 208	88	94	4000	4375	4454	4276
IRAT 112	80	80	3300	3688	4188	3725
IRAT 109	75	83	3175	4828	3125	3709
ROK 16	116	99	3225	4250	3579	3685
LOCAL(CHECK)	-	-	3700	1438	3781	2973

FERTILIZERS: N-60 KG/HA, P_2O_5 - 40 KG/HA, K_2O - 40 KG/HA.

Table 4, shows the performance of promising selections in the uplands of Babungo and Beifang. Though the altitudes are different, the same varieties appear to do well and these varieties could be tested by farmers and development agencies before large scale cultivation.

RICE AGRONOMY

INTRODUCTION

Nineteen hundred eighty-six was the fifth year of activities of the NCRE Rice Agronomy team based at IRA-Dschang. As in preceding years, 1986-87 trials were conducted at Mbo and Ndop Plains, and most activities were involved in irrigated rice research. This year, upland rice research plans at Mbo Plain was completely deleted because of non-funding this research item by SODERIM. However, activities in cropping systems component technology research were continued because this research was funded by SODERIM. Majority of this year's trials were follow-ups of preceding crop seasons to confirm earlier findings. No new trials were planned this year because of IRA budgetary problems. The 1986-87 research plans and their execution, therefore, were limited to available resources from IRA and financial supports given by SODERIM at Mbo Plain and UNVDA at Ndop Plain.

Inspite of continued inadequacy of technical hands available to the team since the inception of the project the team was able to conduct appreciable number of field trials at Mbo and Ndop Plains to maintain the continuity of the past work and generate additional information to attain set research goals, and facilitate on-the-job training to the junior IRA scientists and field technicians working with the team.

This year, the trials at Ndop Plain were h.t by a unexpected hailstorm on the 31st of October, 1986 and caused considerable damage to the experimental plots at post-heading and early maturity stages on the day of hailstorm.

Among the important and critical agronomic constraints affecting yields of rice and other crops at the two locations the following were given priorities, and research plans were drawn to find appropriate solutions to the constraints :

1. Time of planting of the locally selected best rice lines at the two ecologies (Mbo and Ndop Plains).

2. Methods of land preparation for irrigated rice at Mbo Plain.

3. Efficiency of different fertilizer products with respect to their quantities, time and methods of application.

4. Green manuring, a low input technology, used to improve rice yield and maintain soil fertility.

5. Fertilizer needs of upland crops at Mbo Plain including maize, soybean, cowpea, sweet potato and cassava.

6. Appropriate seedling ages and plant spacings needed to optimize irrigated rice yields.

7. Mechanization of rice transplanting to minimize transplanting costs and human drudgery.

8. Feasibility of double cropping upland areas of Mbo Plain using a rice-based cropping pattern involving maize, soybean and rice in the cropping sequence where rice is being grown as the second season crop following the first season maize, soybean or maize/soybean intercrop.

9. Investigation on the problem of empty shells in peanuts at Mbo Plain, and

10 Identification of suitable non-grain legumes as a green manure crop adaptable to Mbo Plain soil-environmental conditions.

Methods :

A total of 11 fertilizer trials with irrigated rice, seven at Ndop Plain and four at Mbo Plain, were conducted during the season. These trials included various aspects of fertilizer management including sources and rates of nitrogen; sources, rates and frequency of P-fertilizer application; green manuring with Crotalaria; and hand vs. machine application of prilled urea and urea supergranules (USG) in irrigated rice. The test N-sources were: prilled urea (PU); sulfur-coated urea (SCU); urea supergranules (USG); diammonium phosphate (DAP); ammonium sulfate (AS); and 20-10-10 compound fertilizer. The test P-sources included single superphosphate (SSP); triple superphosphate (TSP); Phosmak; tricalcium phosphate (TCP); diammonium phosphate (DAP); and bicalcium phosphate (BCP). The experimental design was a RCBD with four replications for all trials except nitrogen response which had a split-plot design with N rates as the main plots and cultivars as the sub-plots with four replications. Plot sizes varied from 15 to 30 sq. m. All fertilizer trials except nitrogen response were conducted with the best elite selection at each location. The N response trial had three best selections at Ndop Plain and four at Mbo Plain as the test cultivars.

An on-farm fertilizer trail with five rates of 20-10-10 fertilizer was conducted in six different sectors of Ndop Plain on the request of UNVDA using RCBD with four replications at each location.

Cultural management trials with irrigated rice were conducted on date of planting, plant population, seedling age, methods of land preparation, and manual versus machine transplanting of irrigated rice. The date of planting trial had five elite lines at Ndop Plain and seven at Mbo Plain laid out in split-plot design with dates of planting as the main plots and cultivars as the sub-plots replicated four times. The plant population and seedling age trials, each had two cultivars. The plant spacings were 16, 28 and 40 hills per sq. m. The seedling ages varied from 3 to 8 weeks at transplanting. The experimental design was a split-plot with cultivars as the main plots and plant spacings as the sub-plots, and seedling ages as the main plots and cultivars as the sub-plots. There were four replications/each trial. The machine versus manual transplanting trial was conducted in non-replicated single plots of 325 and 250 sq. m. at Ndop and Mbo Plain, respectively. All cultural management trials were conducted with optimum dosages of fertilizer application at each location. All trials were protected against insect pests and bird damage taking appropriate protection measures.

Among the rainfed-upland trials, one was involved in green manuring second season upland rice with Crotalaria in the first season super-imposed with four levels of N-fertilizer. The design was a RCBD with 4 replications. A second trial tested a cropping pattern at Mbo Plain with maize, soybean, or maize/soybean intercrop in the first season followed by upland rice in the second season laid out in RCBD replicated six times in 30 sq. m. plots.

In a third set of trials, maize, cowpea, soybean, sweet potato and cassava were tested under seven levels of applied fertilizers and/or organic manure. These trials were laid out in RCBD with seven treatments replicated six times in plots of 40 to 50 sq. m. In addition, a fertility trial involving nine treatments replicated four times laid out in 16 sq. m. plots was conducted to investigate the problems of empty shells in peanuts at Mbo Plain. Finally, a single plot observational trial on nine different species of non-grain legumes was conducted in 200 sq. m. plots each to find an adaptable legume suitable as a green manure crop under Mbo Plain ecological conditions.

Results :

In the N-response trial at Ndop Plain most test lines responded well to applied N and there was an average yield increase of about one t/ha over control due to application of 80 kg N/ha as urea. Among the test cultivars RNR 29692 had the highest yield of 3.33 t/ha at 100 kg N/ha. At Mbo Plain, the mean highest yield was 5.4 t/ha as compared to 5.0 t/ha in the control plots. At this location, yield responses to nitrogen application were marginal in all test lines probably because of high availability of soil N at the experimental site indicated by high control plot yields. Among the test lines ITA 222 had the highest yield (5.5 t/ha) at this location. Based on research station trials it will be possible to recommend N needs of test cultivars which have gone through at least three crop seasons in this trial. Additional trials will, however, be needed for the new entries in this trial to make N-fertilizer recommendations.

In the collaborative INSFFER N-efficiency trial (with IRRI), IR 7167-33-2-3 showed significant N response at Ndop Plain, and at this location both SCU and USG looked superior to PU with respect to rice yield. Application of PU in three equal splits looked better than in two splits. At Mbo Plain, IITA 212 neither show any visible N response nor any response to N sources, and this was associated with considerable incidence of neck and leaf blast in the crop which resulted in high grain sterility. This trial conducted at Ndop Plain since 1983 proved the superiority of SCU and USG over PU for irrigated rice. Based on research station findings recommendations now could be made in favour of SCU and USG as better N-fertilizers for irrigated rice. Additional trials at Mbo Plain with blast tolerant cultivars will be needed to conclude results of this trial at Mbo Plain. The trial on hand versus machine application of PU and USG in irrigated rice conducted at Ndop Plain did not produce encouraging results because of high coefficient of variations in the experiment.

Green manuring irrigated rice with <u>Crotalaria</u> (grown <u>in situ</u>) again showed considerable promise at Ndop Plain in 1986 crop season. Green manuring improved rice yield substantially over that of N alone. At Mbo Plain, similar yield responses to green manuring were recorded in rainfed-upland rice (IRAT 10). This trial showed an advantage of over 30 percent yield increase due to green manuring over 60 kg N/ha applied as urea. Based on the results of the past three seasons at Ndop Plain and two seasons at Mbo Plain <u>Crotalaria</u> green manure now can be recommended as a low input technology to improve rice yields and conserve soil fertility at both the ecologies.

In a first year trial at Ndop Plain, comparing DAP, PU, AS, and 20-10-10 compound fertilizer as sources on N for irrigated rice, DAP applied basal followed by PU top-dress looked to be the best combination for rice yield at the experimental site. In a second trial on the dosage of 20-10-10 at the research station, rice yield increased by over one t/ha over control by an application of 500 kg of 20-10-10/ha. Results of the same trial conducted in farmers' fields across six sectors of Ndop Plain also showed a mean yield increase of about one t/ha over control at the same rate of applied 20-10-10. These results, however, need further confirmation at least for another two crop seasons at the research station and in farmers' fields before any recommendation is made.

In the third year trial on the effect of different land preparation methods on rice yields and N response in irrigated at Mbo Plain, earlier results were confirmed that a thorough land puddling with a cage-wheel tractor is needed for better N response and satisfactory rice yields. This year's results, however, did not prove the superiority of IRRI power tiller over hand hoe with respect to rice yield and N efficiency in contrast to our earlier two years findings. Based on the mean results of the last three years' trials it could be concluded that the superiority of land preparation methods in respect of N response and rice yields stand in the following order: cage wheel IRRI power tiller hand hoe.

In the 5th crop of INSFFER P-source trial at Ndop Plain, TSP at 60 kg P_2O_5/ha produced the highest grain yield. Phosmak and TCP were inferior to TSP in the 5th crop. Based on the mean results of the last five crop seasons (1982-86) it may be concluded that al he three P sources tested at Ndop Plain were almost equally effective in irrigated rice with respect to rice yields. Over five crop seasons, however, plots receiving 60 kg P_2O_5/ha as TSP produced the highest grain yield.

At Mbo Plain, in the first crop of a trial comparing SSP, TSP, DAP, BCP, and TCP as P sources for irrigated rice the highest yield was recorded for plots receiving 40 kg P_2O_5/ha as TSP. In the second crop of along-term study comparing the rates and frequencies of P application in irrigated rice at Mbo Plain on marked effect of either P rates or frequency of P fertilizer application was observed on rice yield. These trials need to be continued on the same layout at least for five crop seasons before any conclusion can be drawn on the results.

In the date of planting trial at Ndop Plain, three of the five test lines had the highest yields when seeded end of May and transplanted about a month after seeding. Subsequent seeding dates resulted in yield declines in all test lines, except July 30 seeding which produced higher grain yields. All test lines except Tainan-V had a very low grain yields when seeded on August 15 and transplanted three weeks later. Based on several parameters evaluated in this trial t could be concluded that under Ndop Plain ecology IR 7167-33-2-3 and Tainan-V could be planted late (seeded mid-August) with a sacrifice of about 50 percent yield losses. The rest of the cultivars (elite selections) must be seeded latest by the end of July and transplanted 3-4 weeks after seeding in order to achieve satisfactory grain yields.

At Mbo Plain, effect of planting dates on varietal grain yields varied with cultivars. Among the seven elite selections tested in this trial Cisadane performed well in all plantings (seeded 1st, 15th and 25th August and transplanted four weeks after seeding). Cica-8 and ITA 212 were considerably affected by blast in all three plantings. ITA 222, in general, performed better in the later seeding. The trial shall be followed up in 1987 to generate more information on varietal reactions to planting dates at Mbo Plain.

At Ndop Plain, 1986 results confirmed earlier findings that 3-5 weeks old seedlings are optimum for short duration cultivars while for medium to long duration cultivars seedling ages at transplanting could be extended upto about 6-7 weeks without appreciable yield losses. Under Ndop soil-environmental conditions 25cm × 25cm or 16 hills/sq. m. plant spacing was found to be optimum for the present varietal types.

The trial comparing IRRI designed Rice Transplanter with manual transplanting of irrigated rice in its third year, proved that use of the transplanting machine with proper seedlings and appropriate plant spacings could produce rice yields similar to that obtained by manual transplanting, and at the same time machine transplanting could effectively reduce labour requirements for transplanting from 25-30 hours in manual transplanting to about 6-8 hours in machine transplanting including seedling preparation for machine feeding, thus economizing rice transplanting to a great extent. This technology can now be easily extended to farmers' fields.

In the maize fertilizer trial at Mbo Plain with Kasai-I and Ekona Yellow as the test cultivars mean yields in both cultivars were 5.0 t/ha. In Kasai-I over 23 percent yield increase over control was achieved by application of 150-120-60 fertilizer rate or by the use of 10 t/ha of pig manure. In Ekona Yellow, the highest yield increase of 21 percent over control was achieved by the application of 100-120-60 fertilizer rate. Fertilizer recommendations for maize at Mbo Plain will be made after the harvest and compilation of the results of the 1987 crop.

In cowpea fertilizer trial (variety V 506) at Mbo Plain, grain yields varied from 886 to about 1336 kg/ha, the highest yield increase (about 50% over control) being recorded for plots receiving 60-50-30 fertilizer rate.

In soybean fertilizer trial (variety Sj 299) at Mbo Plain, grain yields varied from 889 to 1842 kg/ha with the highest yield increase (112% over control) being recorded for 10 t/ha of pig manure application followed by the 60-150-30 fertilizer treatment which brought an yield increase of about 90 percent over control.

In the sweet potato fertilizer trial (clone: TI hl), fresh tuber yields varied from 11.6 to 17.2 t/ha, the highest yield being recorded for plots receiving 80-80-100 plus 5 t/ha of pig manure. The plot yields of sweet potato, however, could not be correctly assessed because of unauthorized tuber harvests from some of the plots by unknown harvesters.

No measurable effect of Ca, Mg, S, P, K, and B treatments was observed on the empty shell percentage of peanuts in the peanut fertility trial at Mbo Plain. Percentage empty shells in this trial across treatments ranged from 16.2 to 22.4, and the plots produced about 200 to 300 g peanut grains (filled) per sq. m., which is considered to be quite satisfactory under Mbo Plain soil-climatic conditions. The trial shall be followed up in 1987 looking at the effect of planting dates on the percentage of filled grains in peanut variety A-657.

In the second year of the rice-based cropping pattern study at Mbo Plain where the second season upland rice crop followed the first season maize, soybean or maize/soybean intercrop, rice yield varied from 1.5 to 1.7 t/ha. The first season crops of sole maize, sole soybean, and maize/soybean intercrops produced 3.3 t/ha of maize, 1.5 t/ha of soybean, and 3.3 tons of maize plus 500 kg soybean per hectare, respectively. Results of the past two years trials indicate that in the upland areas of Mbo Plain it is feasible to go for a rice-based cropping pattern using maize, soybean or maize/soybean intercrop in the first season (March-July), and a short cycle upland rice (IRAT-10) in the second season (July-October).

Of the several non-grain legumes evaluated at Mbo Plain for their suitability as green manure crop Crotalaria caricia (from Zaire) and Tephrosia sp. (local) were found most promising. These two species were the fastest growers under Mbo Plain conditions and produced about 35-45 t/ha of green matter in about 65-75 days with good nodulation capacities under the experimental soil conditions. Sesbania sp. (local) was also found satisfactory but a little slower in growth as compared to Crotalaria, and both could be effectively used for green manuring upland as well as irrigated rice fields provided they are seeded at least 75-85 days before planting rice. Mucuna utilis and Peuraria sp. are slow growing vines but these species cover land surface well after about 45 DAS and suppress weeds well. These two species could be well utilized as cover crops for upland cultures like maize, soybean, cowpea, cassava, yams etc.

S U C C E S S

Many of the 1986 agronomy trials were in their third year of investigation while others were in their first or second year of observation. We are now in a position to write recommendations for the first group of trials, and follow-up the trials in the second group to their second or third year for confirmation of the past findings.

Among the several cultural practices tested in the field to improve irrigated rice yields, we are now in a position to recommend machine transplanting, appropriate seedling ages of the present cultural types, optimum plant spacings for the present cultivars, optimum planting dates for the elite selections at Mbo and Ndop Plains, and better land preparation methods for Mbo Plain.

We can now give tentative fertilizer recommendations, awaiting confirmatory results, including nitrogen and phosphate fertilizer sources and their rates, better methods of their application, recommend the use of Crotalaria as a green manure for rice and non-rice crops as a low input technology to improve crop yields and restore soil fertility, and economise N-fertilizer use.

We are in a position to tentatively recommend fertilizer needs of maize, cowpea, sweet potato, and soybean at Mbo Plain after three years of our field trials on the same layouts while awaiting 1987 results to conclude. We are also in a position to recommend a rice-based cropping pattern for Mbo Plain upland ecology involving maize, soybean, and maize/soybean intercrop in the first season (March-July) and rainfed-upland rice (variety IRAT 10) in the second season (July - November).

We were able to bring the IRA - Dschang soil-plant analytical laboratory partly into operation during the year, and awaiting the appointment of a laboratory technician for the laboratory to bring it under regular operation.

We were able to complete collection of two seasons' weather data for Ndop Plain using the newly established NCRE/UNVDA Weather station at the rice research site at Bamunka farm, Ndop Plain.

During the year we were able to offer on-the-job training to the junior IRA scientist and field technicians working with the Agronomy team in the field and laboratory.

P R O B L E M S

i. This year we faced considerable IRA budgetary problems in executing our planned research projects.

ii. We faced similar problems of financial support from SODERIM at Mbo Plain for which we were obliged to completely drop our upland rice research plans.

iii. Continued shortages of technical hands and temporary workers in the the field limited and delayed our field activities considerably.

iv. Lack of farm equipments, particularly those for land preparation and post-harvest operations slowed down our field activities and kept us far behind our time schedule.

v. Lack of the appointment of a laboratory technician did not allow us to bring the laboratory to regular operation as planned for.

vi. Unforeseen hailstorm at the Ndop Plain experimental site partly damaged many of our experimental plots and affected the results.

vii. Unauthorized and long absences of the only Field Technician in charge of the agronomy trials at Mbo Plain during the growing season created considerable problems in proper execution of field trials at this location.

VI. APPENDIX

Table 1. Varietal response to nitrogen fertilizer under irrigated condition. Mbo Plain. 1986 Wet Season.

N-rate (kg/ha)	grain yield (kg/ha)[a]				Mean (Nitrogen)
	ITA 212	ITA 222	Nang Heip 75-5	Cisadane	
0	5023	5273	4878	5060	5058
20	5175	5260	5177	5175	5197
40	5057	5855	5391	5047	5338
60	4956	5644	5088	5458	5286
80	5259	5638	5259	5355	5378
100	5148	5667	5061	5258	5283
Mean (variety)	5102	5556	5142	5226	

[a] Averages of four replications. LSD (5%) - Nitrogen levels = 534 kg/ha; LSD (5%) - variety = 272 kg/ha; LSD (5%) - variety within main-plot (N-level) = 666 kg/ha; LSD (5%) - variety in different main-plots (N-level) = 786 kg/ha. CV = 8.9%.

Table 2. Varietal Response to Nitrogen fertilizer in irrigated rice. Ndop Plain. 1986 2nd cycle.

N-rate (kg/ha)	grain yield (kg/ha)[a]			Nitrogen Mean
	IR 7167-33-2-3	B29838-SR-51-2-1	RNR29692	
0	2035	2173	2087	2098
20	2284	2373	2276	2311
40	2574	2712	2854	2713
60	2232	2451	2548	2411
80	2852	3104	3330	3095
100	2922	2626	3616	3054
Variety Mean	2483	2573	2785	

[a] Average of your replications. LSD (5%) for Nitrogen levels = 534 kg/ha; LSD (5%) for variety = 425 kg/ha; CV = 27.7%. Date of 50% flowering = 10 - 17 October; Date of maturity = 7-10 November; Date of harvest = 26 November.

Table 3. Effect of green manuring upland rice (IRAT 10) with Crotalaria sp. on rice grain yield. Mbo Plain. 1986 wet season.[a]

Treatment N-applied (kg/ha	Treatment Green manure (t/ha)	Panicle/ sq.m	Grain yield (kg/ha)	Yield increase overcheck (%)
0	0	113	890	-
0	37	119	1186	33.2
30	0	118	1218	36.8
30	30	142	1394	56.6
60	0	109	1186	33.2
60	31	125	1484	67.0
90	0	128	1496	68.1
90	35	106	1167	31.1

[a] Average of four replications. LSD (5%) = 338 kg grain/ha. CV = 18.3%

Table 4. Effect of planting dates on the yield performances of seven elite lines. Mbo plain. 1986 2nd season.

Variety/Selection	Grain Yield (kg/ha)[a] Seeding date August 1	Seeding date August 14	Seeding date August 28	Mean (variety)
ITA 212	3775	5334	5065	4725
ITA 222	5229	4836	6228	5431
Hang Hiep	5671	6764	5214	5882
Cica 8	3188	3995	2540	3241
IR 3273-339-2-5	4372	4037	4103	4171
Tainan V	4027	4661	3859	4183
Cisadane	5504	5379	5257	5380
Mean (Seeding date)	4538	5001	4610	

[a] Average of four replications. LSD (5%) for seeding dates = 1722 kg/ha; LSD (5%) for variety = 1136 kg/ha; CV(a) = 16.10%; CV(b) = 14.54%.

Table 5. Effect Seedling age on varietal grain yields (stagered planting) Ndop plain. 1985 2nd cycle.[a]

	HPU 741			B2161-C-MR-57-1-3-1		
Seedling age (weeks)	Tiller/m[2]	Pan/m[2]	grain yield (kg/ha)	tiller/m[2]	Pan/m[2]	grain yield (kg/ha)
3	287	160	1252	215	195	3060
4	250	161	1265	219	174	2867
5	261	133	741	231	188	2539
6	210	154	829	222	170	1848
7	199	144	2188	206	155	1771
Mean	241	150	1255	219	176	2417

[a] Average of four replications. LSD (5%) for seedling age = 290 kg/ha; LSD (5%) for variety = 170 kg/ha; LSD (5%) for variety within the same seedling age = 380 kg/ha; LSD (5%) for variety in different seedling age = 395 kg/ha; CV = 13.7%. The crops (particularly HPU 741) was badly hit by October 31 hailstorm and had severe grain shattering (in plots planted to 3-6 week old seedlings.

Table 6. Effect of Seedling age on varietal grain yields (Stagered Seeding) planted on August 22. Ndop plain, 1986 2nd season.[a]

	HPU 741			B2161-C-MR-57-1-3-1		
Seedling age (weeks)	Tiller/m[2]	Pan/m[2]	grain yield (kg/ha)	Tiller/m[2]	Pan/m[2]	grain yield (kg/ha)
3	256	188	4130	297	219	5138
4	292	251	4348	295	220	4543
5	267	211	2439	265	225	3479
6	298	199	1905	197	243	3839
7	259	213	2622	258	222	4761
8	270	223	2985	278	210	4486
Mean	274	214	3071	265	223	4374

[a] Average of four replications. LSD (5%) for seedling age = 446 kg/ha; LSD (5%) for variety = 773 kg/ha: CV = 20.34%. Date of maturity: HPU 761 = 25-30 November; B2161 = 30 November - 7 December.

Table 7. Varietal response to plant spacings. Ndop plain. 1986 2nd cycle.[a]

Plant Spacing	B2161-C-MR-57-1-3-1 Tiller/ m^2	Pan./ m^2	grain yield (kg/ha)	HPU 741 Tiller/ m^2	Pan./m^2	grain yield (kg/ha)
25cm x 25cm	161	155	4227	173	157	3631
25cm x 15cm	299	272	3757	311	267	3380
25cm x 10 cm	366	266	3852	400	352	3608
Mean	275	231	3945	295	259	3540

[a] Average of four replications. L.S.D. (5%) for plant spacing = 767 kg/ha; LSD (5%) for variety = 543 kg/ha; LSD (5%) for plant spacing within the same variety = 768 kg/ha; LSD (5%) for plant spacing in different variety = 973 kg/ha. CV = 13.3%.

Table 8. Fertilizer response in Maize. Mbo plain. 1986 1st cycle.

Fertilizers Applied (kg/ha) N	P_2O_5	K_2O	Org. manure	Grain Yield[a] (kg/ha) Ekona Yellow	Kasai - I	Yield Increase Over check (%) Ekona Yellow	Kasai - I
0	0	0	0	4760	4871	-	-
60	60	40	0	5267	5471	10.6	12.3
90	60	60	0	5422	5323	13.9	9.3
100	120	60	0	5767	5377	21.1	10.4
150	120	60	0	5201	5464	9.3	22.4
0	0	0	10,000	5283	5988	11.0	22.9
150	120	60	5,000	4214	5061	- 11.0	3.9
Mean (variety)				5131	5366		

[a] Average of six replications. LSD (5%) - fertilizer levels = 933 kg/ha; LSD (5%) - variety = 499 kg/ha; CV = 21.77%.

Table 9. Fertilizer response in cowpea[a]
Mbo plain, 1986 1st cycle.

Fertilizers Applied (kg/ha)				Mean Grain Yield (kg/ha)[b]	Increase Over Check (%)
N	P_2O_5	K_2O	Org. Manure		
0	0	0	0	886	-
30	50	0	0	999	12.7
30	100	0	0	1007	13.6
30	150	0	0	1026	15.8
60	150	30	0	1046	18.0
0	0	0	10,000	1018	14.9
60	150	30	5,000	1336	50.8

[a] Variety - V 506; [b] Average of six replications. LSD (5%) = 55.19 kg/ha; CV = 4.5%.

[b] Average of six replications. LSD (5%) = 55.19 kg/ha; CV = 4.5%.

Table 10. Fertilizer response in Soybean[a]
Mbo plain. 1986 1st cycle

Fertilizers applied (kg/ha)				Grain Yield[b] (kg/ha)	Yield Increase Over Check (%)
N	P_2O_5	K_2O	Org. Manure		
0	0	0	0	869	-
30	50	0	0	1183	36.1
30	100	0	0	1511	73.9
30	150	0	0	1541	77.3
60	150	30	0	1647	89.5
0	0	0	10,000	1842	112.0
60	150	30	5,000	1502	72.8

[a] Variety = Sj 199; [b] Average of six replications; LSD (5%) = 285.45 kg/ha; CV = 16.8%.

Table 11. Fertilizer response in Sweet Potatoes[a] Mbo plain. 1986 1st cycle.

Fertilizers Applied (kg/ha)				Fresh Tuber[b] Yield (t/ha)	Yield Increase Over Check (%)
N	P_2O_5	K_2O	Org. Manure		
0	0	0	0	11.63	-
40	40	40	0	15.02	29.15
40	60	60	0	16.69	43.50
60	60	80	0	14.79	27.17
80	80	100	0	14.75	26.83
0	0	0	10,000	15.79	35.77
80	80	100	5,000	17.19	47.81

[a] Variety = TIB1 [b] Average of six replications; LSD (5%) = 2.32 t/ha; CV = 13.0%.

Table 12. Effect of different nutrients on the percentage of empty shells in peanuts at Mbo plain. 1986 1st season[a]

Treat. No.	Nutrients Applied (kg/ha)	Number of Shells/sq.m. filled	empty	Percent Empty Shells
1	Check (no fertilizer)	324	77	19.6
2	Dolomite - 3000 kg/ha	422	82	16.3
3	Triple Super phosphate 100 kg P_2O_5 /ha	321	76	19.0
4	Single Super phosphate (100 kg P_2O_5 + 60 kg s/ha)	335	73	18.6
5	N_{20} - P_2O_5 100-K_2O 60	334	87	16.3
6	N_{20} - P_2O_5 100-K_2O 60 + Dolomite 3000 kg/ha	380	78	17.2
7	N_{20} - P_2O_5 100-K_2O 60 + S 60 kg/ha	338	93	22.4
8	Dolomite - seed treatment	398	77	16.2
9	N_{20} P_2O_5 100 -K_2O 60 + B (foliar spray)	358	75	17.1

[a] Average of four replications. CV = 10.98%. Treatment effects were statistically insignificant. Plot size = 16m^2; variety = A657. Date of seeding = 4 April, 1986.

Table 13. Crop yields in a rice-based cropping pattern trial at Mbo plain. 1985 and 1986[a]

Crop Association	First Season Grain Yield (kg/ha) 1985	1986	LER[b] 1985	1986	Second Season Rice Yield[c] (kg/ha) 1986
Maize	4716				
Peanut	0	-	1.06	-	-
Maize	4623	3300			
Soybean	433	493	1.73	1.30	1492
Maize	3450				
Cowpea	606	-	1.76	-	-
Maize-sole	4437	3340	1.00	1.00	1573
Peanut-sole	0	-	1.00	-	-
Soybean-sole	625	1553	1.00	1.00	1739
Cowpea-sole	613	-	1.00	-	-

a Average of four replications in 1985 and of six replications in 1986.

b LER - Land Equivalent Ratio

c CV = 20.5%

Fig. 1. Meteorological Data, Mbo Plain (1986)

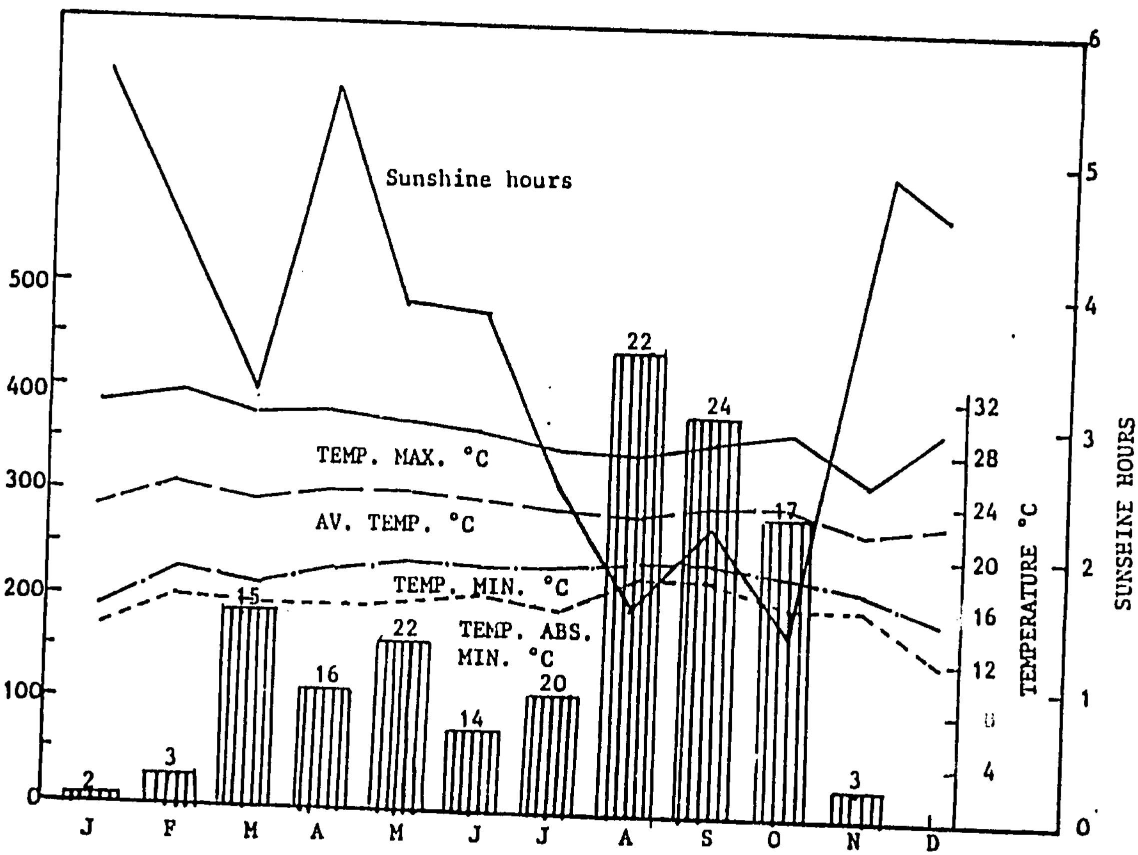


Fig. 2. Meteorological Data, Ndop Plain (1986 growing season).

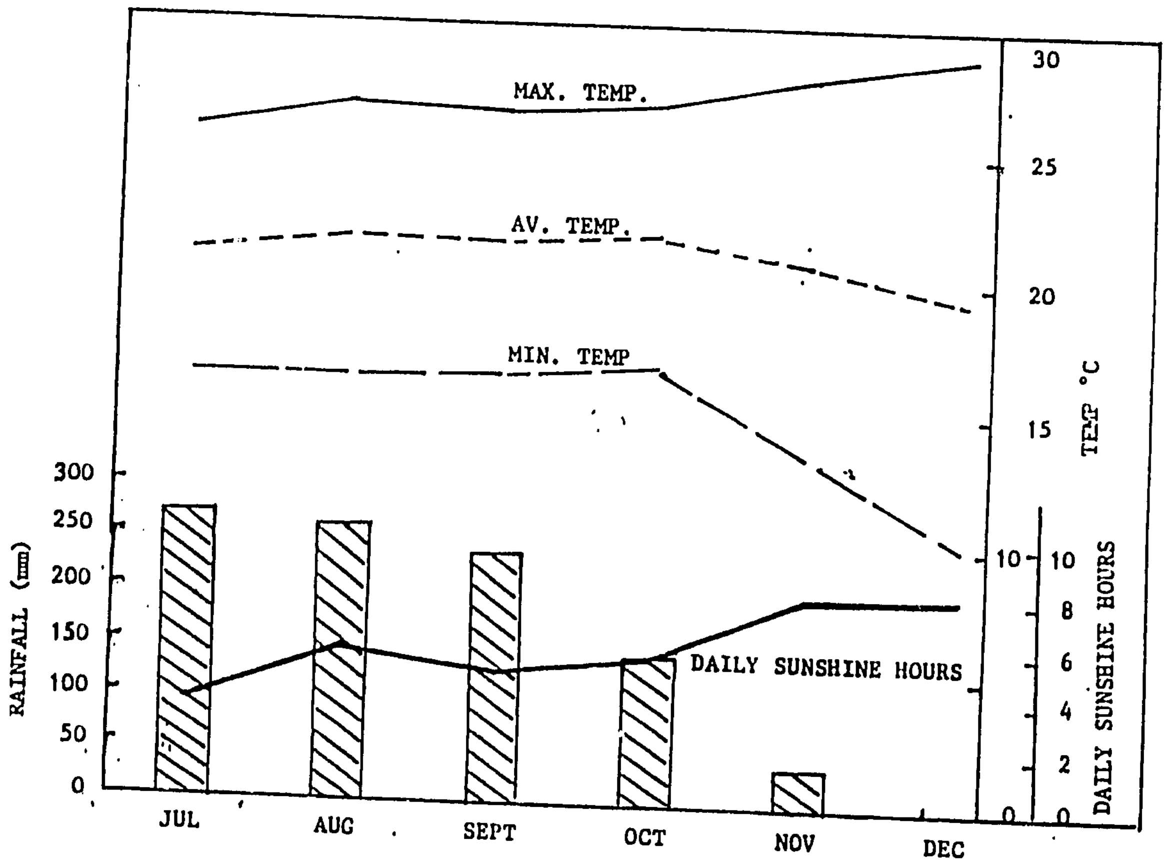


Fig 3 N – Fertilizer Efficiency in Rice

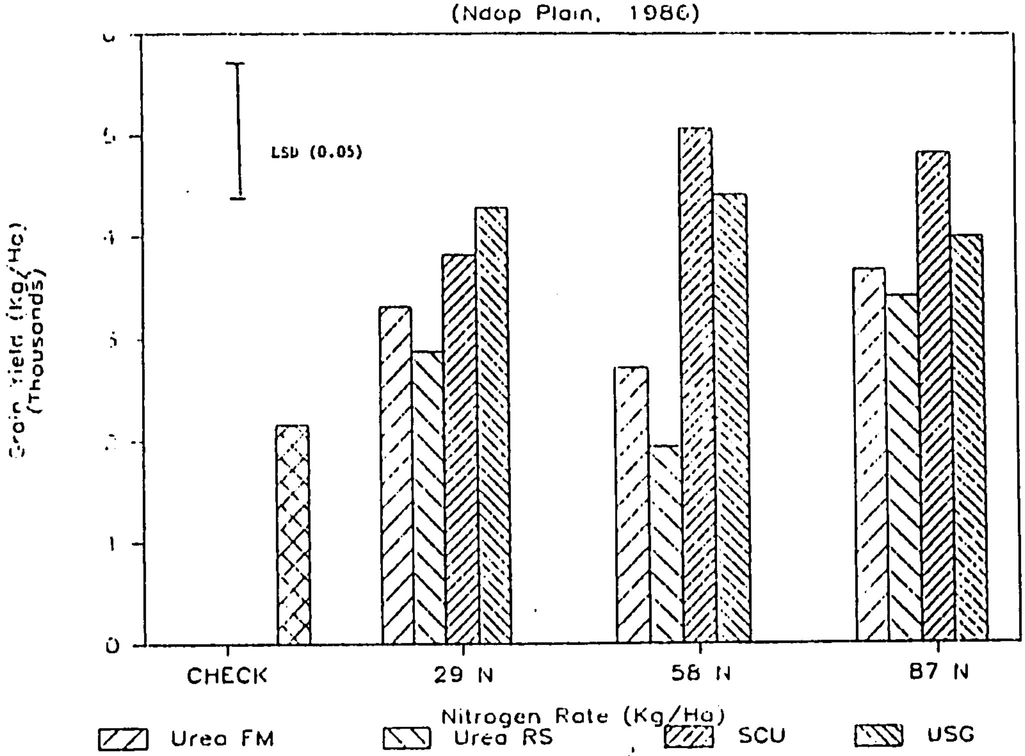


Fig 4 Effect of Green Manure on Rice Yield

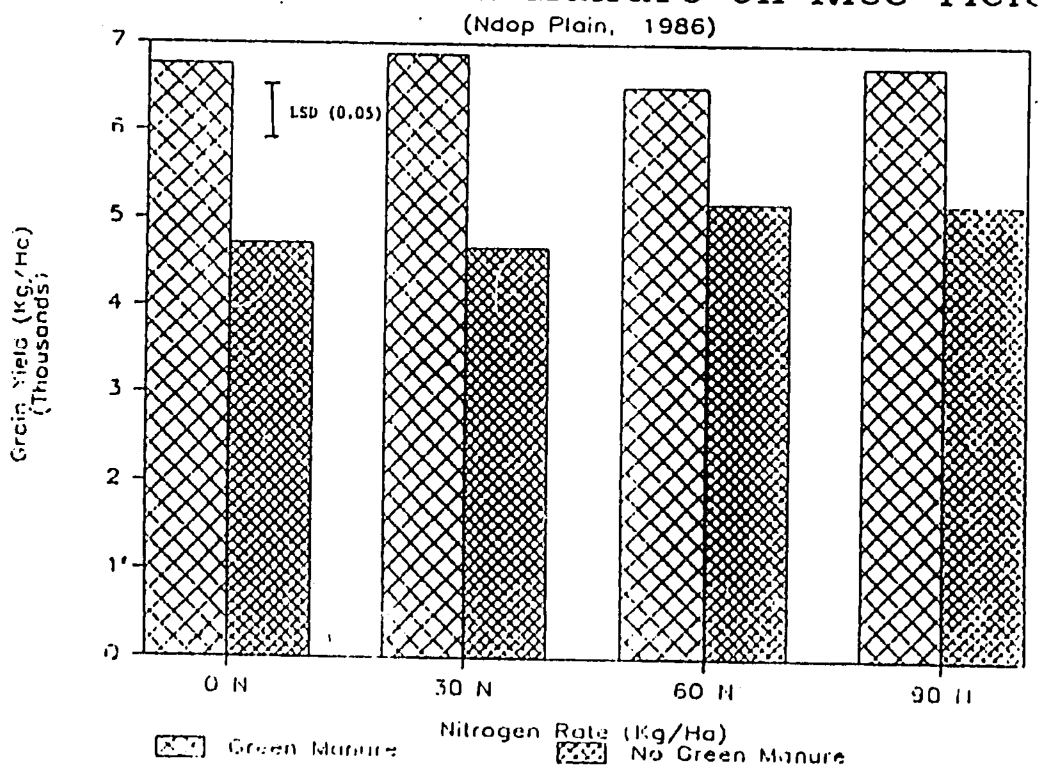


Fig 5 Comparison of N Fertilizers in Rice

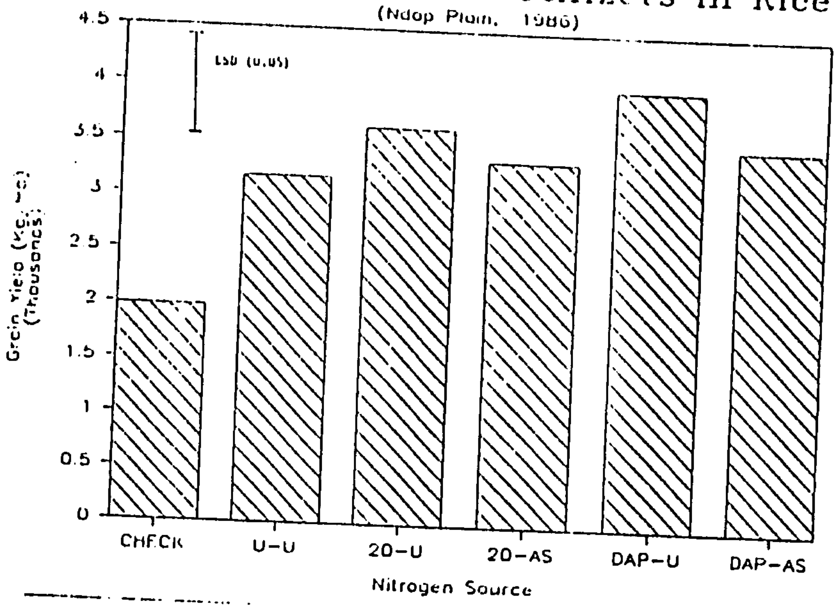


Fig 6 Rice Yield Response to 20-10-10 Fert.

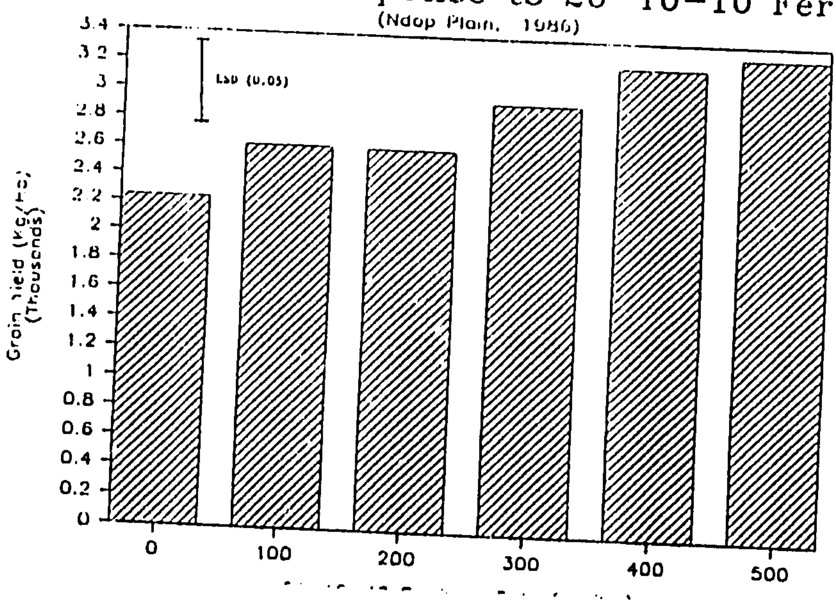


Fig. 7 Rice Response to 20–10–10 Fertilizer

(Farmers' Fields, Ndop Plain – 1986)

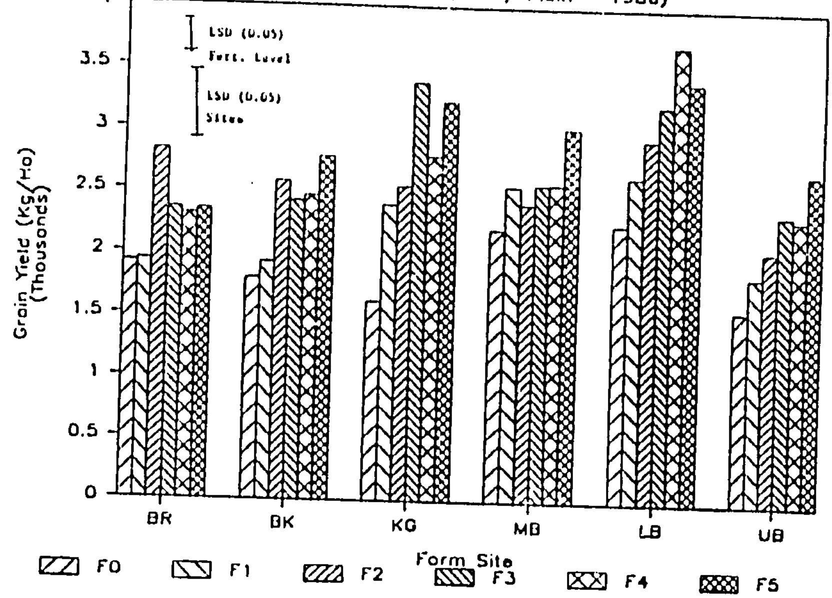


Fig. 8 Varietal Response to Planting Dates

(Ndop Plain, 1986)

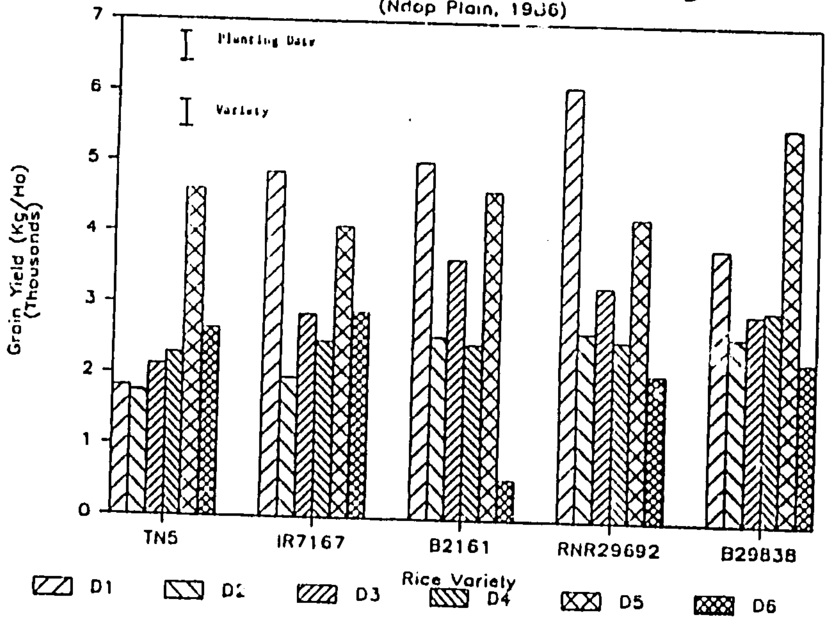
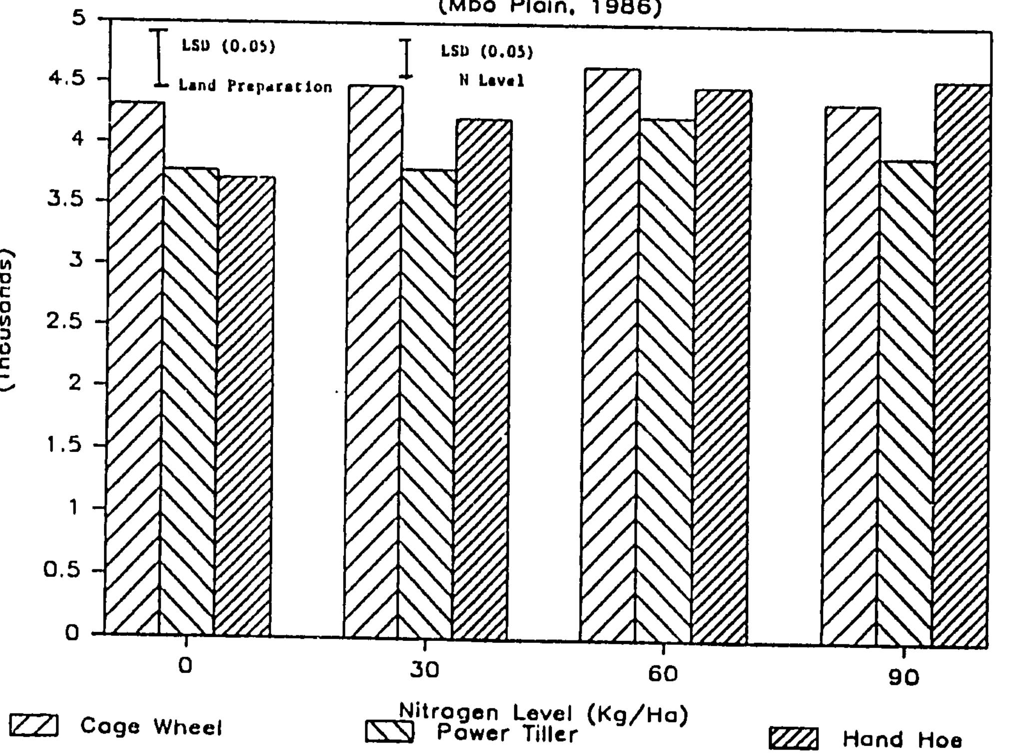


Fig 9 Land Prep x N-Level in Irrigated Rice

(Mbo Plain, 1986)



C E R E A L S   A G R O N O M Y

I N T R O D U C T I O N

The NCRE Cereals Agronomy Unit devotes 70% of its research efforts to maize agronomy and 30% to sorghum agronomy.

This research - which started in 1982 - has been conducted in the main maize and sorghum-growing regions of the Adamoua, North and Extreme North Provinces (6 to 13^{o} latitude N, 160 000 km^{2}). For research purpose, the area is divided into the following main regions (each subdivided into subzones): the highland plateaux of Adamaoua, the subhumid lowland savanna, and the semi-arid lowland savanna.

Maize and sorghum are two important cereals crops in Northern Cameroon. They are cultivated mostly by small farmers. They are often grown as sole crops, intercrops and, in rotation with cotton and/or legume crops (mostly groundnut and cowpea). The cropping systems vary with the agroclimatic and marketing conditions. Their main uses includes: human food, feed and fodder for livestock, local beverages, fuel, fences. Maize is also consumed "green" during the hungry period to fill the food deficit.
In Northern Cameroon, the maize area under traditional and intensive cultivation is estimated to be around 70 000 hectares. It has increased significantly in the last five years (partly as a result of the introduction of better varieties and cultural practices), and will continue to increase in the near future - particularly in the subhumid lowland savanna and the highlands of Adamaoua.

The total area under sorghum production (rainy season and off-season) is about 430 000 hectares. The sorghum production is located mainly in the lowland semi-arid subhumid savanna.

Farmers in many areas show great interest for the maize and sorghum crops and have requested agronomic packages about their cultivation. Relatively little agronomic research on these crops was conducted in Northern Cameroon before the start of the NCRE Project. Since 1982, agronomic research on these crops have intensified in Northern Cameroon in close cooperation with the NCRE maize and sorghum breeders, the agricultural agencies. Our NCRE agronomic research is: production oriented - aimed at alleviating the main agronomic constraints for increased maize and sorghum production - taking into consideration the different cropping systems used in the different cereals growing regions - and developping improved and adapted cultural packages for the farmers of the different regions of Northern Cameroon. Our research results have been so far quite encouraging.

The following have been identified as major agronomic constraints for increased maize and sorghum production in North Cameroon:

- Lack of suitable maize and sorghum varieties in some zones
- Lack of adequate cropping systems to maintain long-term crop and soil productivity.
- Insufficient rainfall in some parts of the savanna and an erratic rainfall pattern in many areas.
- Water runoff losses and soil erosion, particularly in the lowland savanna. The type of intensive and agressive rainfall is causing erosion problems in the fragile soils of the lowland savanna when cultivated. A substantial amount of rain is lost by run-off.
- Soil fertility problems, deficiency of several nutrient elements (particularly) N and P, S, Mg) and low level of organic matter in many soils. Soil acidity and high P fixation in the ferrallitic soils of the highland of Adamaoua.
- Inadequate knowledge on cultural practices (soil and water management, planting dates, plant densities, intercropping techniques, soil and seed treatments, irrigation,
- Weeds problems.
- Disease and pests (termites, borers, birds, striga, monkeys, blights, streak).
- Crop lodging.
- Inadequate post harvest technologies and lack of proper storage facilities.
- Marketing problems.

The research strategies and priorities summarized in this workplan were developed as a result of suggestions from agricultural agencies and farmers, and experience and knowledge accumulated in the last four cropping seasons.

RESEARCH OPERATIONS CONDUCTED IN 1986

During the 1986 cropping season, we have conducted a series of <u>22 field trials on maize agronomy</u> and <u>20 field trials on sorghum agronomy</u> in the lowland savanna and the highland plateau of Adamaoua.

Studies on Water and Soil Management and Conservation with Maize and Sorghum in the Lowland Savanna of Northern Cameroon.

The main objective of this operation was to evaluate the effect of different techniques of land preparation, tied ridges and other practices associated with water and soil conservation and water use efficiency on the performance and yield of improved maize and sorghum varieties in the lowland savanna of Northern Cameroon. An additional objective was to compare the results obtained on-station versus on farmers'fields as to the efficiency of these techniques. This research operation started last year.

In 1986 - responding to requests of the extension agencies, the emphasis was placed on testing the effeciency of tied ridges vs. simple ridges and to determine what distance the farmers should tie the ridges to have the most effective impact from this technique in different locations of the lowland savanna. Varietal response of maize and sorghum was also evaluated. Furthermore some preliminary studies were made on reduced and minimum tillage with maize and sorghum.

This year we have also started a study on strip cropping of crops with legume crops (grain and green manure crops). The main idea of this research was to develop a cropping system - as an alternative to the system used by most farmers - which reduce rainfall water run-off and soil erosion - two major constraints in the whole region. Finally on a vertisol of Karewa, we have conducted an observational trial involving the comparison of planting on ridge versus on flat bed in an effort alleviate a severe plant establishment and yield constraints on maize and sorghum production.

Fertilization Management on Maize under different Cropping Systems in Northern Cameroon.

This study started in 1983 and was conducted mainly in the lowland subhumid and semi-arid regions of Northern Cameroon. During the 1986 cropping season, the fertilization management trials were carried out mainly in the highlands of Adamaoua. The main objectives were to determine the fertility constraints of these ferrallitic soils and to determine the optimum rates of fertilizer (N, P and micronutrients) needed to reach the maize yield potential after cotton. Varietal response to these factors was measured using a hybrid SR-52 and an open pollinated variety SHABA I (newly released variety by NCRE). Some trials were also conducted to evaluate the effect of different rates and sources of fertilizer on maize yield in different locations of the Adamaoua in an effort to make some preliminary recommendations on the basis of available fertilizer in the region.

Furthermore we have continued the lime and P Studies under three cropping systems (maize-maize, maize-soybean, wheat-maize) at SODEBLE, Wassande. Our objective was to evaluate the short and long term effect of lime and P in the ferrallitic and acid soils of Adamaoua.

Effect of Soil Insecticides and Seed Treatment on Plant Establisnment and Yield of Maize and Sorghum in the Lowland Savanna.

This research effort was initiated last year and results so far are quite interesting. In 1986, this operation was conducted mainly to compare the effect of different insecticides as to rates, ways and times of application and seed treatments on plant establishment and yield of maize and sorghum in different locations of the lowland savanna.

Effect of Planting Dates on Maize in Northern Cameroon. This study started four years ago. The main objective of these trials was to evaluate the response of several improved maize varieties to planting dates in two locations of the Adamaoua Province. The ultimate objective is to make recommendations to the farmers of this region concerning the optimal planting dates for maize in different zones.

Performance of Several Improved Maize Varieties at Different Locations of the Lowland Savanna. These trials were conducted in cooperation with the NCRE lowland maize breeders.

The main objective was to compare the yield potential of three improved maize varieties under intensive management at several locations of the lowland savanna.

Studies in Intercropping Maize with Groundnuts or Sorghum with Groundnuts or Cowpea in the Lowland Savanna of Northern Cameroon.

This study started two years ago and involved mostly intercropping maize with cowpea. In 1986, the emphasis was placed on intercropping maize and sorghum with groundnuts or cowpea.

The main objectives were to compare the monocropping versus intercropping patterns and to test several associations of maize or sorghum (of different maturity cycles) with groundnut and cowpea (of different maturity cycles) in the lowland subhumid savanna.

Taste or palatability Test with Maize and Sorghum.
The main objective of these prelinary test is to test farmers' acceptance of the new improved varieties of maize and sorghum in Northern Cameroon. The maize varieties were: CMS8501 (a promising 90 day variety for the Sudano-Sahelian region), SHABA I (an open pollinated variety recenty released by the NCRE for the highlands of Adamaoua. The sorghum varieties are: S-34 and CS-63 (new promising varieties selected by NCRE).

NORTH CAMEROON - SOME SELECTED AGROCLIMATIC CHARACTERISTICS OF THE SITES USED FOR CEREALS RESEARCH IN 1986

SITES	DEPARTMENT	SOIL CLASSIFICATION	RAINFALL	RAINY DAYS
1. IRA GUETALE	MAYO TSANAGA	Alluvions peu évoluées	635.2mm	53
2. IRA GUIRING	DIAMARE	Alluvions récentes	783. 5 mm	59
3. IRA SOUCOUNDOU	MAYO LOUTI	Sol rouge tropical	937.9mm	69
4. IRA BERE	BENOUE	Planosol	1018.3mm	61
5. IRA SANGUERE	BENOUE	Sol Ferrugineux tropical	891.7mm	66
6. IRA MAKEBI	KAELE	Sol Ferrugineux tropical	679.3mm	65
7. KAREWA FARM	BENOUE	Sol Vertic	757.3 mm	72
8. TCHOLLIRE	MAYO REY	Sol Ferrugineux tropical	1184 mm	78
9. MBE FARM	VINA	Sol Ferrugineux tropical	1371 mm	-
10. IRA TOUBORO	MAYO REY	Sol Ferrugineux tropical lessivé	1030 mm	92
11. IRA MBANG MBIRNI	LA VINA	Sol Ferralitique	1455.4mm	122
12. SODEBLE WASSANDE	LA VINA	Sol Ferralitique	Not availble	-

GENERAL COMMENTS CONCERNING OUR 1986 AGRONOMIC RESEARCH ON MAIZE IN NORTHERN CAMEROON.

1. The maize experiments were planted during the months of April and May in the Adamaoua Province, and during the months of June and July in the North and Extreme North Provinces.

2. Specific information concerning the soil, climatic, biotic and management factors for each site is discussed in the NCRE Annual Report 1985.

- The principal maize varieties used as tests crops in our trials were: SHABA I and SR-52 in the highlands of Adamaoua, and TZPB, Mexican 17E, CMS-8501 and Safita 2B in the lowland savanna.

- As land preparation, we used a tractor to plow and disk the soil in most cases.

- Appropriate fertilization and management was given to the trials.

- Yield of maize are expressed in Kg/ha using 14% humidity.

In our fourth year of maize agronomy research in Northern Cameroon, and following the recommendations of the IRA Maize Committee - emphsis was put on evaluation of the yield potential of several improved varieties under different management levels at different locations, soil and water management (use of tied ridges, raised beds versus flat beds, reduced and minimum tillage, responses to fertilizer applications under different cropping systems, responses to planting dates, responses to lime and P fertilizer in the ferrallitic soils of Adamaoua, effect of soil insecticides and seed treatments on maize, strip cropping, and intercropping trials, taste test with varieties CMS-8501 and SHABA - I.

3. In general, results and observations during the 1986 cropping season usually confirm those of the previous years. The subhumid lowland savanna and the highland plateaux of Northern Cameroon have a good potential for successful and profitable maize production. Maize grain yields recorded in 1986 experiments raised up to 10 t/ha for the variety CMS-8501 in the lowland savanna, and up to 12 t/ha for the variety SR-52 in the highlands of Adamaoua. In farmers fields, the maximum yield went up to 7 t/ha with the variety TZPB.

4. <u>Maize growth and yield were relatively good in most research sites</u> - even in the Extreme North (the semi-arid zones). This situation is partly due to a better rainfall regime (more abundant and regularly distributed rainfall in 1986).
However, in some locations plants were negatively affected by <u>rainfall water run-off, soil erosion, termites, striga, lodging, and magnesium deficiency</u>. In many farmers fields in the subhumid lowland savanna, maize showed a better performance than that of last year. Important progress in crop management was made by many small farmers. However, it was observed <u>in a lot of farmers' fields a relative low maize stand -which has reduced yield substantially</u>.

MAIZE RESULTS AND INTERPRETATION

WATER AND SOIL MANAGEMENT AND CONSERVATION ON MAIZE IN THE LOWLAND SAVANNA OF NORTHERN CAMEROON.

Effect of tied ridges on maize grain yield at several locations of the lowland savanna of Northern Cameroon.

For this experiment, six locations were selected: Makebi, Soucoundou, Bere, Sanguere, Kismatari and Guiring. The maize varieties used at test crops were: TZPB, CMS-8501 Mexican 17E and Safita 2B. A split plot design was used in these trials.

The discusion of the results is summarized in the following sections.

a) There was a highly significant difference between treatments at Soucoundou, Bere, and Makebi. The use of tied ridges was up to 22% over the check- 1.8t/ha, which would represent a monetary value of 108.000 FCFA/ha. Similar trends were reported in other regions of semi-arid African tropics-particularly in tropical ferruginous soils of predominantly sandy texture (Alfisol). It was observed in most plots with tied ridges a better water retention, less runoff and less soil erosion damage. Therefore the risks of drought stress were relatively reduced for the maize plants in these plots.

b) The yield of both varieties showed highly significant differences at Soucoundou and Makebi. CMS-8501 out-performed Mexican 17E and Safita 2B. The interaction tied ridges X varieties was not significant in all the sites. This would indicate that the impact of tied ridges <u>is independent of the maize varieties</u>

c) From the analysis of data and our observations, it was concluded that tying the ridges every 5 m seems to have the most beneficial impact, on the average resulting in higher yield or net benefit.

d) At Sanguere, there was a 22% raise in grain yield due to tied ridges but significant differences among treatments were not found.

e) At Guiring, a yield depression was observed (although not significant statistically).

f) Recommendation - this study should be continued at more locations, and with different planting dates (early versus late planting) to confirm our results. Some on - farm research will be undertaken to evaluate the effect of tied ridges in large scale (1/4 of an hectare) on farmers' fields.

TABLE :

EFFECT OF TIED RIDGES ON MAIZE GRAIN YIELD IN FIVE LOCATIONS IN THE LOWLAND SAVANNA OF NORTHERN CAMEROON (1986)

TREATMENTS	SOUCOUNDOU		BERE		MAKEBI		SANGUERE	GUIRING
	Mexican 17E	CMS - 8501	TZPB	CMS-8501	SAFITA 2B	CMS-8501	Mexican 17E	CMS-8501
1. Simple ridges	7242	8023	5966	6255	5893	6299	4175	8116
2. Tied ridges (every 2.5m)	8408	9483	7028	7233	6143	6975	4884	6131
3. Tied ridges (every 5m)	8663	9815	6720	6711	6608	7262	5104	6352
4. Tied ridges (every 7.5m)	7644	9316	6686	6872	6221	6740	5023	7932

AT SOUCOUNDOU: F_T = Sig (1%); F_V = Sig (1%); F_{TXV} = N.S. LSD = 520 CV= 8%

AT BERE : F_T = Sig (1%); F_V = N.S.; F_{TXV} = N.S. LSD = 460; CV= 8%

AT MAKEBI F_T = Sig (1%); F_V = Sig (1%); F_{TXV} = N.S. LSD = 440; CV= 7%

AT SANGUERE : F_T = N.S; F_V = N.S. CV = 16%

AT GUIRING F_T = N.S; F_V = N.S. CV; = 15%

FERTILIZATION MANAGEMENT ON MAIZE UNDER DIFFERENT CROPPING SYSTEMS IN NORTHERN CAMEROON.

A. Response of Improved Maize Varieties to Applied Fertilizer after Cotton on a Representative Ferrallitic Soil of the Highlands of Adamaoua.

1. During the last two years, these trials were planted after fallow. Results are reported in the NCRE Annual Reports 1984 and 1985.

2. The selected site was Mbang Mbirni. Two varieties were used: SHABA I (an open pollinated variety recently released to the farmers of the highlands) and the hybrid SR-52. A RCB design was used.

3. The discussion of the results is summarised in the following sections.

a) As observed in the previous years, the hybrid SR-52 showed a better and more uniform growth and yield performance than the open-pollinated SHABA I at all the fertilizer levels. Maximum yield for SR-52 was up to 12 t/ha as compared to 10.6 t/ha for SHABA I (which represents an increase of 1349 kg/ha, 13% over SHABA I). This relative superiority was lower than that of last year (2.2 t/ha, 31%).

There was a significant difference between the fertilizer treatments. Both varieties showed significant response to N, P, S and Mg. In the case of SR-52, maximum yield increase with applied fertilizer was about 6163 kg/ha (an increase of 105%). In the case of SHABA I, it was up to 5039 kg/ha (an increase of 89% over the check).

b) As compared to 1985 results, the response to fertilizer was of lesser magnitude. The absolute grain yield were much higher at all levels of fertilizer whenever maize was planted after a fertilized crop (cotton) that after fallow (1984 and 1985). It seems that after fallow there were several fertility constraints which reduced maize yield.

c) As recorded in the previous years, maximum yield was obtained with the use of $MgSO_4$. It is believed that to achieve the yield potential of these high yielding varieties in this ferrallitic soil, kieserite ($Mg\ SO_4$) may be necessary. More research is needed to confirm this point.

d) Other conclusions coming from the statistical analysis: the N and P responses were highly significant. The interaction N x P was not significant. There was significant difference for variety x P, and for variety x N x P interaction. It is interesting to note that the interaction variety x N was significant. This would indicate the response to N will vary with the varieties.

B. Effect of Different Sources and Rates of fertilizer on Maize Grown on Representative Soils of the Province of Adamaoua.

4. Three sites were selected: a) Mbang Mbirni (IRA substation) about 1050 m. elevation with ferrallitic soil derived from granite, with cotton as preceding crop. b) Wakwa (Projet Semencier Farm about 100 m. elevation with a ferrallitic soil derived from basalt. Maize was planted after fallow. c) Mbe MINAGRIC Farm), about 600 m. elevation with a tropical ferruginous soil (Alfisol). The preceeding crop was sweet potato. A RCB design was used in these trials.

The discussion of the results is summarized in the following section.

a) The 1986 trials confirm our previous observation that high and profitable maize production could be achieved in the Adamaoua Province whenever appropriate management is given to the crop. It was recorded that maximum grain yields of 8.5 t/ha at Wakwa, 12 t/ha at Mbang Mbirni, and 7 t/ha at Mbe. There was substantial yield increase due to fertilizer application in the three locations.

b) MBE: There was a greater response to fertilizer at the site which has a sandy tropical ferrugninous soil (Alfisol), as compared to that obtained in the ferrallitic soils (Ultisol) of heavier texture at Mbang Mbirni and Wakwa. Furthermore at Mbe, the preceeding crop was sweet potato. This root-crop as well as yam - tends to deplete the soils of nutrient elements (particularly when they are not fertilized). The farmers of this region who are interested in a rotation (sweet potato or yam followed by maize) - should fertilize the maize crop properly if they want to achieve a good yield with maize and maintain the productivity of the cropping systems.

c) The use of 100 kg of fertilizer (20-10-10) and 150 kg/ha of Urea resulted in an increase of 2.5 t/ha (with a potential value of 156.780 FCFA. At the subsidized cost of 2.500 FCFA per bag of 50 kg, the fertilizer applied would cost a total of 12.500 FCFA - which would give a net benefit of 144.280 FCFA. Every kg of fertilizer is associated to a benefit of 577FCFA. On the average, there seems to have been no significant difference between the three sources of fertilizer.

d) MBANG MBIRNI: There was a highly significant difference between treatments. On the average, the maize yields - even the check level - were higher than the previous years when maize was planted after fallow. This situation might be due to the carry-over effect of the fertilizer applied to the preceding crop. Maize showed a yield increase of up to 5.6 t/ha (80% over the check), for hybrid SR-52 and up to 4.3 t/ha (71% over the check) for SHABA I. On the average, the hybrid SR-52 responded more to applied fertilizer.

e) WAKWA: Although the treated plots showed a yield increase over the check, this difference was not significant at 5% level. At this site the plants show a particularly good seedling vigor, uniform and heathly development with practically few symptoms of diseases and insects. This fact is partly due to the relatively fertile soil exisiting in this area.

- Recommendations: This study should be continued involving more sites and other varieties to confirm our findings. Fertilizer research involving Mg SO4 should be used in the lowland and upland soils to determine the response to Magnesium and sulphur more accurately.

EFFECT OF FERTILIZER ON GRAIN YIELD OF TWO VARIETIES OF MAIZE AFTER COTTON IN THE HIGHLANDS PLATEAUX OF ADAMAOUA, MBANG MBIRNI (1986)

TREATMENTS (kg/ha)			SHABA I		SR-52 (HYBRID)	
	N	P_2O_5	kg/ha	RGY (%)	kg/ha	RGY (%)
1.	0	0	5666	100	5883	100
2.	0	75	5972	105	6637	113
3.	0	150	6257	110	6723	114
4.	0	225	6388	113	6831	116
5.	50	0	7219	127	8813	150
6.	50	75	7819	138	9029	153
7.	50	150	7831	138	9159	156
8.	50	225	7875	139	9978	170
9.	100	0	7460	132	8620	147
10.	100	75	8391	148	10408	177
11.	100	150	8816	156	11077	188
12.	100	225	8641	153	10344	176
13.	150	0	7875	139	9202	156
14.	150	75	8072	142	9310	158
15.	150	150	8116	143	9719	165
16.	150	225	8969	158	9805	167
17.	Y	+ 20 S	9560	169	11378	193
18.	Y	+ 20 MgO	10697	189	12046	205
19.	Y	+ 20 S	9253	163	11486	195
20.	Y		8734	155	9741	166

Y = 150 N + 150 P_2O_5; treatment 19 = SODECOTON fertilizer (15-20-15-6 S-1 B)

Treatment 20 = DAP (Diammonium phosphate 18 - 46); treatment 18: = scurce of Mg is Mg SO4 (Kieserite)

For SHABA I: F_T = Sig.(1%) LSD = 1049 C.V. = 13%

For SR - 52: F_T = Sig.(1%) LSD = 1203 C.V. = 13%

TABLE EFFECT OF DIFFERENT RATES AND SOURCES OF FERTILIZER ON MAIZE GRAIN YIELD IN THE PROVINCE OF ADAMAOUA WAKWA AND MBE (1986)

TREATMENTS	WAKWA			MBE		
	SHABA I			TZPB		
	Yield, kg/ha	Yield increase kg/ha	Yield increase %	Yield kg/ha	Yield increase kg/ha	Yield increase %
1. Control	6329	-	-	3464	-	-
2. 100 kg/ha of (15-20-15-6-1)	8322	1993	31	6105	2641	76
3. 200 kg/ha of " " " " "	9067	2738	43	6588	3124	90
4. 300 kg/ha of " " " " "	8913	2584	41	6900	3036	99
5. 100 kg/ha of DAP (18-46-0)	8519	2190	35	5878	2414	69
6. 200 kg/ha of DAP	8278	1949	31	6361	2897	83
7. 300 kg/ha of DAP	8563	2234	35	7497	4044	116
8. 100 kg/ha of (20-10-10)	8300	1971	31	6077	2613	75
9. 200 kg/ha of " " "	8541	2212	35	6304	2840	81
10. 300 kg/ha of " " "	8388	2059	33	6957	3493	100

All the plots except the control received a post plant application of 150 kg. Urea/ha.

Cotton fertilizer: 15-20-15-6-1; DAP = Diammonium phosphate (18-46-0).

AT WAKWA: F_T = N.S.; F_{REP} = N.S.; C.V. = 14%.

AT MBE: F_T = Sig. (1%); F_{REP} = (1%); LSD = 588; C.V. = 8%.

TABLE EFFECT OF DIFFERENT RATES AND SOURCES OF FERTILIZER ON MAIZE GRAIN YIELD IN THE PROVINCE OF ADAMAOUA, MBANG MBIRNI (1986)

TREATMENTS	MBANG MBIRNI					
	SHABA I			HYBRID SR - 52		
	Yield kg/ha	Yield increase kg/ha	Yield increase %	Yield kg/ha	Yield increase kg/ha	Yield increase %
1. Control	6053	-	-	7036	-	-
2. 100 kg/ha of (15-20-15-6-1)	8063	2010	33	10860	3824	54
3. 200 kg/ha of " " " " "	8809	2756	46	11581	4545	65
4. 300 kg/ha of " " " " "	9549	3496	58	10641	3605	51
5. 100 kg/ha of DAP (18-46-0)	8238	2185	36	10882	3846	55
6. 200 kg/ha of DAP	8303	2250	37	10663	3627	52
7. 300 kg/ha of DAP	10357	4304	71	10969	3933	56
8. 100 kg/ha of (20-10-10)	9176	3123	52	11231	4195	60
9. 200 kg/ha of " " "	9527	3474	57	11275	4239	60
10. 300 kg/ha of " " "	10051	3998	66	12673	5637	80

All the plots except the control received a post plant application of 150 kg. Urea/ha

Cotton fertilizer: 15-20-15-6-1, DAP = Diammonium phosphate (18-46-0).

AT MBANG MBIRNI: For SHABA I = F_T = Sig. (1%); F_{REP} = Sig. (1%); LSD = 839; C.V. = 9%

For SR - 52 = F_T = Sig. (1%); F_{REP} = Sig. (1%); LSD, = 839; C.V. = 10%

EFFECT OF SOIL INSECTICIDES AND SEED TREATMENTS ON PLANT ESTABLISHMENT AND YIELD OF MAIZE IN THE LOWLAND SAVANNA OF NORTHERN CAMEROON.

A. Effect of Several Rates, Ways and Times of Applications of Soil Insecticides on the Performance and Yield of Maize in the Lowland Savanna.

1. Maize varieties used as test crops are: Mexican 17E and CMS-8502 at Soucoundou, Safita 2B at Makebe, and TZPB at Kismatari.

   The trial at Kismatari was not harvested because the plants were severely damaged by water run-off and soil erosion. A RCB design was used in these trials. Furadan 10G is granular soil insecticide with carbofuran as active ingredient, and Mocap 10G is a granular soil insecticide with ethoprophos as active ingredient. The control plots had seed treated with Thioral (at the rate of 200g/100 kg of seed). Thioral - which is used as standard seed treatment by the farmers - is a chemical with TMTD and 25% heptachlore.

2. The discusion of the results is summarized in the following sections.

a) Experimental evidence accummulated in the last two years - as well as our observations in many farmers' fields-tend to confirm the findings of the SAFGRAD/IITA team at Burkina Faso on the same subject: soil insect pests and termites are major limiting factors to increased cereals production in many locations of the savanna of the semi-arid African tropics.

b) In 1986, there was a highly significant difference between treatments. Grain yields in the treated plots raised up to 10 t/ha for CMS-8501, 8.7 t/ha for Mexican 17E, and 6.6 t/ha for Safita 2B. As observed in 1985, the plots treated with Furadan 10G had maize plants with better seedling establishment, better stand and more vigor, and less damage by insects. It was reported similar beneficial effects in other places where the insecticide Furadan is used as standard practice.

c) On the average, plots treated with Furadan 10G outyielded significantly the plots treated with Mocap. At Makebi, the use of Mocap was associated with symptoms of plant toxiticity and reduced stand on maize. There appears to be no significant differences between the use of 20kg and 10kg per hectare of Furadan 10G. At the rate of 10kg/ha we obtained a yield increase of 2514 kg/ha - which would have monetary value of 151,000 FCFA. The cost of 10 kg Furadan 10G is 12 000 FCFA. To offset this cost an extra yield of 200 kg/ha of maize is required..

d) On the average, there was no significant difference between split application versus single dose appliation. This is contrary to the findings of last year. This is probably related to the observation that most of the damage by soil insect pest seem to have occured at the earlier stage of growth in our research sites in 1986.

e) Treatments of maize seed with Marshal 25ST only gave important yield increase of up to 1.533 t/ha (21%) for Mexican 17E, 1.832 kg/ha (23%) for CMS-8501 at Soucoundou while it was up to 736 kg/ha at Makebi. Marshal 25 ST was used at the rate of 3 kg/100 kg of maize seed.

3. Recommendations: More research should be conducted on this subject including other chemicals and at more locations.

TABLE EFFECT OF DIFFERENT RATES AND TIMES OF APPLICATION OF SOIL INSECTICIDES IN MAIZE GRAIN YIELD IN THE LOWLAND SAVANNA, SOUCOUNDOU (1986)

TREATMENTS	SOUCOUNDOU					
	Mexican 17E			CMS - 8501		
	Yield kg/ha	Yield increase kg/ha	Yield increase %	Yield kg/ha	Yield increase kg/ha	Yield increase %
1. Control (Thioral)	7254	-	-	7945	-	-
2. Furadan (X) applied at planting	8684	1430	20	9713	1768	22
3. " " at 30 DAP	8187	933	13	9500	1555	20
4. " split: (½X) at planting + (½X) at 30 DAP	8415	1161	16	10565	2620	33
5. Furadan (½X) applied at planting	8704	1450	20	10459	2514	32
6. " " " at DAP	7855	601	8	9330	1385	17
7. " split (1/4X) at planting + (1/4X) at DAP	8767	1513	21	9628	1683	21
8. Mocap (X) applied at planting	7378	124	2	8946	1001	13
9. " " split (½X) at planting + (½X) at DAP	7710	456	6	8712	767	10
10. Furadan (X) split (½X) at planting + (½X) in the whorl	8199	945	13	9415	1470	19
11. Seed treated with Marshal 25 ST	8787	1533	21	9777	1832	23
12. Seed treated with Marshal 25 ST + (½X) Furadan at 30 DAP	8290	1036	14	10224	2279	29

+ Furadan (X) = Furadan 10 G at the rate of 20 kg/ha ; Mocap (X) = Mocap 10 G at the rate of 15 kg/ha.

Marshal 25 ST is a seed treatment. DAP = Days after planting

AT SOUCOUNDOU For Mexican 17E = F_T = Sig. (1%); LSD = 651; C.V.; = 9%. For CMS-8501 = F_T = Sig. (1%) ; LSD= 678; C.V. =7%

TABLE EFFECT OF DIFFERENT RATES AND TIMES OF APPLICATION OF SOIL INSECTICIDES ON MAIZE GRAIN YIELD IN THE LOWLAND SAVANNA, MAKEBI (1986)

TREATMENTS	MAKEBI		
	SAFITA 2B		
	Yield kg/ha	Yield increase kg/ha	Yield increase %
1. Control (Thioral)	5214	-	-
2. Furadan (X) applied at planting	6160	946	18
3. " " at 30 DAP	6097	883	17
4. split: (½X) at planting (½X) at 30 DAP	6287	1073	21
5. Furadan (½X) applied at planting	6539	1325	25
6. " " " at DAP	5698	484	9
7. " split (1/4X) at planting	6371	1157	22
8. Mocap (X) applied at planting	5257	42	1
9. " " split (½X) at planting (½X) at DAP	3785	(-1429)	(-27)
10. Furadan (X) split (½X) at planting (½X) in the whorl	6413	1199	23
11. Seed treated with Marshal 25 ST	5950	736	14
12. Seed treated with Marshal 25 ST + (½X) Furadan at 30 DAP	6119	905	17

Furadan (X) = Furadan 10 G at the rate of 20 kg/ha; Mocap (X) = Mocap 10 G at the rate of 15 kg/ha

Marshal 25 ST is a seed treatment; DAP = Days after planting

AT MAKEBI: F_T = Sig. (1%); F_{BL} = Sig. (1%); LSD = 612; C.V. = 10%

B. EFFECT OF SEED TREATMENT ON PLANT ESTABLISHMENT AND YIELD OF MAIZE IN THE LOWLAND SAVANNA.

1. These observational trials were carried out to compare the efficiency of the seed treatment Marshal 25 ST with that of Furadan 10G and Thioral (control) on maize performance in several locations of the lowland savanna and to evaluate the varietal response to these treatments.

2. The varieties selected for this test were: CMS-8501, Mexican 17E, and TZPB and the sites were: Kismatari, Guiring and Soucoundou. The control plots had seed treated with Thioral (at the rate of 200g/100kg of seed). Thioral - which is used as standard seed treatment by farmers - is a chemical with 25% IMID and 25% heptachlore.
Furadan 10G is a granular soil insecticide with carbofuran as active ingredient. A split plot design was used in these trials.

3. Discussion of results is summarized in the following sections.

a) Considering all the trials involving seed treatments and soil insecticides on maize - which Marshal 25 ST was used as treatment at Soucoundou, Makebi, Kismatari, Guiring, it is interesting to note that the use of Marshal 25 ST has brought up in most cases substantial yield increase from 14 to 26% over the check (with Thioral). The maximum yield increase with Marshal 25 ST was about 1832 kg/ha (with a monetary value of 109.920 FCFA). Furthermore it should be remembered that Marshal 25 ST is a seed treatment easier to manipulate by the farmers than Furadan 10G. The cost of Marshal used as treatments in these trials (666 g/ha) is about 4224 FCFA/ha while that of Furadan 10G (10 kgs/ha) is about 12.000 FCFA. All these considerations would make the use of Marshal relatively attractive to the farmers.

b) At KISMATARI: There was a strong and significant response to the treatments. Plots with Marshal 25 ST and Furadan 10G gave higher yields than those of the control with Thioral.
There was no significant difference between varieties, and for interaction, varieties x treatments. This result would indicate that the effect of Marshal 25 ST and Furadan 10G is independent of the varieties. On the average, the yield increase due to the use of 10 kgs./ha of Furadan was higher than that of Marshal 25 ST. In general, the check plots (with Thioral) had plants with lower population density, seedling vigor, and reduced growth.

Thioral does not seem to be an effective seed treatment in case of severe infestation of termites and or/soil insects. The low density observed in many farmers field is probably related to damage to maize crop by soil insects and termites; thioral which is used commonly as seed treatment for maize may not give in most cases an adequate control of the soil pests prevailing in this zone. Further study is needed on this matter before a final conclusion can be reached.

c) At GUIRING: There was no significant difference between treatments, and for the interaction between treatments and varieties. However there was a significant difference between varieties. CMS-8501 out-yielded TZPB by 26% (1825 kg/ha). The fact that CMS-8501 shows a particularly good performance at Guiring makes it attractive as a potential for the sudano-sahelian zones. The maize crop at this site was little affected by the soil pests and termites. It is partly related to the good rainfall regime which left the soil moist during most of the cropping season. Termites tend to be more active in drier conditions like the one of 1984/1985 when a strong response was observed to seed treatments at Guiring.

Recommendations: In view of the interesting results, this investigative effort will continue including other seed treatments at several locations of lowland and upland savanna.

TABLE EFFECT OF DIFFERENT SEED TREATMENT ON MAIZE GRAIN YIELD IN THE LOWLAND SAVANNA, KISMATARI (1986)

TREATMENTS	KISMATARI					
	TZPB			CMS-8501		
	Yield kg/ha	Yield increase kg/ha	Yield increase %	Yield kg/ha	Yield increase kg/ha	Yield increase %
1. Seed treated with Thioral (control)	5475	-	-	5133	-	-
2. Seed treated with MARSHAL 25 ST	6340	865	16	6435	1332	26
3. Seed treated with Furadan 10 G	6576	1101	20	7174	2061	40

AT KISMATARI : F_T = Sig. (5%); F_V = N.S.; F_{TXV} = N.S.; LSD = 980; C.V. = 12%

TABLE EFFECT OF DIFFERENT SEED TREATMENT ON MAIZE GRAIN YIELD IN THE LOWLAND SAVANNA, GUIRING (1986)

TREATMENTS	GUIRING					
	TZPB			CMS-8501		
	Yield kg/ha	Yield increase kg/ha	Yield increase %	Yield kg/ha	Yield decrease kg/ha	Yield decrease %
1. Seed treated with Thioral (control)	7016	-	-	8916	-	-
2. Seed treated with MARSHAL 25 ST	7033	17	-	8827	(-89)	(-1)
3. Seed treated with FURADAN 10 G	7151	135	2	8863	(-53)	(-1)

AT GUIRING : F_T = N.S.; F_V = Sig. (5%); F_{TXV} = N.S.; C.V. = 16%

EFFECT OF PLANTING DATES ON MAIZE IN NORTHERN CAMEROON

1. The varieties used as test crops at Mbang Mbirni were: SHABA I, (a variety recently released to the farmers), hybrid SR-52 (widely used in some modern large farms), and a local variety. The varieties used at Mbe were TZPB, (released in this area) and CMS-8501 (a promising early maturing variety selected by the NCRE lowland maize breeders). A split plot design was used in thses locations.

2. The discussion of the results is summarized in the following sections:

a) MBANG MBIRNI:

1 - As observed in the last years, there is a highly significant difference among treatments. The earlier the planting dates gave the higher maize grain yield in the highlands of Adamaoua. The optimal tme for maize planting in this area seem to be some time before 9 May. It is interesting to note that a striking yield decline when maize of the three varieties were planted after 9 May. In a matter of one week-between 9 May and 16 May it was recorded a yield loss of about 2.5 t/ha for SHABA I, 3.8 t/ha for Hybrid SR-52 and 2.3 t/ha for the local variety. It means an average yield decline per day of 354 kg/ha (21.240 FCFA) for SHABA I, 541 kf/ha (32.460 FCFA) for SR-52 and 333 kg/ha (19.980 FCFA) for the local variety.

2 - The maize varieties used as test crops showed highly significant differences. As expected, improved varieties out-yielded the local varieties, and the hybrid SR-52 out-yielded SHABA I.

3 - As observed in 1985, the rate of yield loss was greater for the hybrid than for the open pollinated varieties. This finding is important for MAISCAM (a large mechanized farm) which use this hybrid SR-52 extensively. It is also relevant for the maize breeding program which test a lot of hybrid maize.

The interaction between planting dates X varieties was not significant which would indicate that the impact of planting dates seem not to depend on the maize varieties.

b) MBE

1. The same tendency described for Mbang Mbirni was observed for TZPB and CMS-8501. At this site, the early planting dates were associated with high/grain yield. It seems that the optimal planting date should be sometime before 5 June. More research is needed to confirm this observation.

2. Between 5 and 12 June, the yield decrease was about 2931 kg/ha for CMS-8501. Mean-while for TZPB it was 3222 kg/ha. The lower yield decline may be due to the fact that CMS-8501 has shorter maturity cycle than TZPB. There was no significant difference - which would indicate that the effect of planting dates was dependant on varieties. Finally it should be pointed out that it was more difficult to having a good stand at the late dates because of increased attacks of rodents to the seeds and the seedings.

Recommendations: More research should be conducted in other locations of the Adamaoua Province to determine the optimal planting dates of maize for each zone.

TABLE EFFECT OF PLANTING DATES ON GRAIN YIELD OF SEVERAL MAIZE VARIETIES IN THE HIGHLANDS OF ADAMAOUA, MBE (1986)

Planting dates	CMS-8501			TZPB		
	Yield kg/ha	Yield decrease kg/ha	RGY(%)	Yield kg/ha	Yield decrease kg/ha	RGY (%)
22 May	8480	-	100	8225	-	100
29 May	8021	(-459)	95	7904	(-321)	96
5 June	8575	+135	94	8196	(-29)	92
12 June	5644	(-2836)	67	4963	(-3263)	60
19 June	5562	(-2918)	66	4744	(-3481)	58

AT MBE: F_T = Sig (1%) ; F_V = N.S.; LSD = 349; F_V = N.S. ; F_{TXV} = N.S.

RGY = Relative Grain Yield

EFFECT OF PLANTING DATES ON GRAIN YIELD OF SEVERAL MAIZE VARIETIES IN THE HIGHLANDS OF ADAMAOUA, MBANG MBIRNI (1986)

Planting Dates	SHABA I			HYBRID SR - 52			LOCAL VARIETY		
	Yield	Yield decrease		Yield	Yield decrease		Yield	Yield decrease	
	kg/ha	kg/ha	RGY (%)	kg/ha	kg/ha	RGY (%)	kg/ha	kg/ha	RGY (%)
2 May	7963	-	100	10315	-	100	5883	-	100
9 May	7817	(-146)	95	9712	(-603)	99	5688	(-195)	97
16 May	5338	(-2478)	58	5919	(-3793)	68	3355	(-2333)	58

AT MBANG MBIRNI : F_T = Sig. (1%) LSD = 554 C.V. 18%; F_V = Sig. (1%); LSD_V = 1253; F_{TXV} = N.S

RGY = Relative grain Yield.

PERFORMANCE OF SEVERAL IMPROVED MAIZE VARIETIES AT DIFFERENT LOCATIONS OF THE LOWLAND SAVANNA.

1. These trials were conducted in cooperation with the NCRE lowland maize breeders. This study was undertaken to compare the yield potential of three improved maize varieties under intensive management in several locations of the lowland savanna.

2. The selected locations were: Pitoa, Sanguere and Tchollire. The maize varieties used as test crops were: a) TZPB - K81, b) Mexican 17E, and c) CMS-8501. A R CB design was used in these trials.

3. The discussion of the results is summarized in the following sections.

a) In 1986, relatively high grain yield of the three varieties tested were obtained at the three locations. This situation is partly due to a more favourable rainfall regime (more abundant and better distribution) prevailing during this cropping season. Maximum yields raised up to more than 9 T/ha for the three varieties. The magnitude of the response vary with sites:

At Sanguere, there was a highly significant difference between the varieties. The yield of CMS-8501 was higher than that of TZPB. During the cropping season, there was a dry spell of about 17 days which affected more severely TZPB than CMS-8501 at this site.

At Tchollire, CMS-8501 outyielded significantly TZPB. The average yield increase was 13%.

At Pitoa, although on the average, CMS-8501 was superior to TZPB and Mexican 17E, but the difference was not significant.

b) Considering all the trials in which the variety CMS-8501 was used as test crop - at Guiring, Makebi, Soucoundou, Bere, Sanguere, Kismatari, Tchollire, Mbe and Pitoa - this variety showed equal or superior yield performance than TZPB or Mexican 17E. It has shown wide adaptability, and is streak resistant and has a maturity cycle of about 90 days.

4. Recommendations: More tests with CMS-8501 should be conducted in the sudano-sahelian zones in cooperation with the breeders. Furthermore this variety should be tested next year in farmers' fields to compare our results obtained on station versus those of farmers' fields.

TABLE GRAIN YIELD OF MAIZE CMS-8501; TZPB (K81) AND MEXICAN 17E IN SEVERAL LOCATIONS OF THE LOWLAND SAVANNA, 1986

PITOA

REPLICATIONS	CMS-8501 (kg/ha)	TZPB (kg/ha)	Mexican 17E (kg/ha)
1	10 010	8585	7343
2	9 493	8670	9486
3	9 838	9010	8415
4	8 716	8840	8168
5	9 925	8670	8663
AVERAGE	9 596	8755	8415

SANGUERE

REPLICATIONS	CMS-8501 (kg/ha)	TZPB (kg/ha)
1	8546	7416
2	7516	7219
3	9164	7787
4	8497	6322
-	-	
	8431	7186

TCHOLLIRE

REPLICATIONS	CMS-8501 (kg/ha)	TZPB (kg/ha)
1	8284	7373
2	8681	8010
3	9400	8475
4	8358	7372
-	-	-
	8358	7372

FOR PITOA : F_V = N.S. ; F_{REP} = N.S. C.V. = 7%

FOR SANGUERE: F_V = Sig. (1%) ; F_{REP} = Sig. (5%); F_{VXR} = N.S. C.V = 8%

FOR TCHOLLIRE: F_V = Sig. (1%) ; F_{REP} = Sig. (1%); F_{VXR} = N.S. C.V = 6%

AVERAGE GRAIN YIELD OF MAIZE CMS-8501, TZPB AND MEXICAN 17E IN AGRONOMIC TRIALS ACCROSS LOCATIONS (1986)

	CMS-8501 kg/ha	TZPB kg/ha	MEXICAN 17E kg/ha
A. Extreme North :			
1. Gutring	8868	7066	-
2. Makebi	6819	-	-
B. North			
3. Soucoundou	9519	-	8185
4. Bere	6767	6600	8351
5. Pitoa	9596	8755	8415
6. Kismatari	6240	6130	-
7. Sanguere	8431	7186	4796
8. Tchollire	8358	7372	-
9. Karowa(on raised bed)	8100	7388	-
10. Karewa (on flat bed)	6578	6234	-
C. Adamaoua			
11. Mbe	7256	6806	-

STUDIES OF INTERCROPPING MAIZE WITH GROUNDNUT IN THE LOWLAND SAVANNA OF NORTHERN CAMEROON

These trials were carried out on a representative tropical ferruginous soil (Alfisol) at Kismatari. A RCB design was used. The maize varieties used were: TZPB (110 - 115 days) versus CMS-8501 (90-95 days). The groundnut varieties used were: 55-437 (90 days) versus M-513 - 77-1 (115 days). The cowpea varieties used were: TXV-3236 (80 days cycle) versus VYA Motourwa (90 days cycle). The maize/cowpea was planted using a pattern of two rows of maize alternating with two rows of cowpeas with a planting distance of 80 cm between the rows. The maize/groundnut was planted using a pattern of two rows of maize alternating with 5 rows of groundnut. The distance between the maize rows was 80 cm while the distance between the groundnut rows was 40 cm.

a) The planting patterns used in these trials seem to be quite practical. They facilitate the management operations, like relay planting, weeding, fertilizer application and harvesting. It would be interesting to test these patterns on farmers' fields in different locations.

b) In both trials, average grain yield of the crops used (maize, groundnut and cowpea) were relatively lower than expected.

c) For both trials, there was a highly significant difference among treatments. Yield of monocrop maize were higher than intercrop maize. The same trend was observed for cowpea and groundnut. These results confirm those obtained in the last three years. Using the land equivalent ratio and monetary value as criteria, monocropping was superior to intercropping.

The extra income in the case of monocrop maize was up to 131.940 FCFA (40%) increase in the maize trial while it was up to 172.600 FCFA (49%) for maize/groundnut trial.

d) Regarding Monocropping: maize variety CMS-8501 performed better than TZPB in both trials. Groundnut variety M-513-77-1 performed better than 55-437.

Regarding Intercropping: the best association appears to be CMS-8501 with the groundnut variety M-513-77-1, and CMS-8501 with cowpea TVX-3236. On the average, maize variety CMS-8501 out-yielded TZPB, and groundnut variety M-513-77-1 out-yielded 55-437. There is no clear explanation for this observation. The maize variety CMS-8501 which has a shorter maturity cycle may be better suited for intercropping.

Recommendation: Study on intercropping sorghum/groundnut should be continued at several locations next year to confirm the results obtained at Kismatari.

TABLE INTERCROPPING EXPERIMENT: MAIZE WITH GROUNDNUT IN THE LOWLAND SAVANNA, KISMATARI (1986)

TREATMENTS			CROP YIELD (kg/ha)					MONETARY VALUE (CFA F)		
			MAIZE		GROUNDNUT			MAIZE	GROUNDNUT	TOTAL
	Maize	Groundnut	(X)	(kg/ha)	(Y)	(kg/ha)	(Z)			
1.	TZPB +	55 -437	0.58	4200	0.36	634	0.94	252 000	50 720	302 720
2.	CMS-8501 +	55 -437	0.43	3777	0.33	588	0.76	226 620	47 040	273 660
3.	TZPB +	M513 -77-1	0.50	3578	0.36	723	0.86	214 680	57 840	272 520
4.	CMS-8501 +	M513 -77-1	0.57	4988	0.31	619	0.88	299 280	49 520	348 800
5.	TZPB (monocrop)	-	-	7188	-	-	-	431 280	-	431 280
6.	CMS-8501 (monocrop)	-	-	8690	-	-	-	521 400	-	521 400
7.	-	55 -437 (monocrop)	-	-	-	1 763	-	-	141 040	141 040
8.	-	M513 -77-1 (monocrop)	-	-	-	1 997	-	-	159 760	159 760

(X) = L.E.R. (Maize); (Y) = L.E.R. (Groundnut); (Z) = L.E.R. Total; L.E.R = Land Equivalent Rario

AT KISMATARI For Maize : F_T = Sig. (1%); LSD = 914; C.V. = 16%; Maize = 60 CFA F/kg

For Groundnut: F_T = Sig. (1%); LSD = 193; C.V. = 17%; Groundnut = 80CFA F/kg

TABLE INTERCROPPING EXPERIMENT: MAIZE WITH COWPEA IN THE LOWLAND SAVANNA, KISMATARI (1986)

TREATMENTS			CROP YIELD (kg/ha)					MONETARY VALUE (CFA F)		
			MAIZE		COWPEA			MAIZE	COWPEA	TOTAL
	Maize	Cowpea	(X)	(kg/ha)	(Y)	(kg/ha)	(Z)			
1.	TZPB +	TVX 3236	0.45	3402	0.30	607	0.75	204 120	91 050	295 170
2.	CMS-8501 +	TVX 3236	0.52	4007	0.29	580	0.81	240 420	87 000	327 420
3.	TZPB +	VYA	0.34	2594	0.34	682	0.68	155 640	102 300	257 940
4.	CMS-8501 +	VYA	0.47	3608	0.31	622	0.78	216 480	93 300	309 780
5.	TZPB monocrop)	-	-	7528	-	-	-	451 680	-	451 680
6.	CMS-8501 monocrop)	-	-	7656	-	-	-	459 360	-	459 360
7.	-	TVX 3236 (monocrop)	-	-	-	2 035	-	-	305 250	305 250
8.	-	VYA (monocrop)	-	-	-	1 985	-	-	297 750	297 750

(X) = L.E.R (Maize); (Y) = L.E.R (Cowpea); (Z) = L.E.R. Total; L.E.R. Land Equivalent Ratio

AT KISMATARI For Maize F_T = Sig.(1%); LSD = 818 ; C.V. = 16%; Maize : = 60 CFA F/kg

For Cowpea F_T = Sig.(1%); LSD = 245; C.V. = 21%; Cowpea: =150 CFA F/kg

TASTE TEST WITH IMPROVED MAIZE VARIETIES.

Results for the maize variety CMS-8501

A total of 110 families participated in this preliminary taste test with the maize variety CMS-8501 in several towns of the North and Extreme North Provinces: Garoua, Soucoundou, Bere, Tchollire and Makebi.

In general 90% stated they liked the variety CMS-8501 very much while 8% liked it a little, and 2% did not like it at all. They appreciate mostly its good taste, its attractive color, and its good cooking qualities. The comments of the families concerning this variety contain a lot of useful information for our research program - especially the breeding program.

GENERAL COMMENTS CONCERNING OUR 1986 AGRONOMIC RESEARCH ON SORGHUM IN NORTHERN CAMEROON:

1. The sorghum experiments were planted during the months of June and July. Specific information concerning the soil, climatic, and biotic and management factors for each site discussed in the NCRE Annual Report 1985.

The principal sorghum varieties used as test crops in our trials were: S-35 and CS-61 in the Extreme North, and S-34 and CS-63, in the North.

The trials conducted in cooperation with Dr. RAO at Guiring are reported in the sorghum agronomy section. So they will not be discussed here.

In general, results and observations during the 1986 cropping season tend to confirm those of the last two years. Most part of the lowland savanna of Northern Cameroon has good potential of sucessful and profitable sorghum production. The maximum grain yield in our experiments this year was around 4 t/ha for S-34 and CS-63 and around 6 t/ha for S-35 and CS-61. The production potential of the improved varieties can be achieved by applying improved and adapted packages of cultural practices. The components of the packages will vary according to the agroclimatic conditions of the different zones.

Sorghum growth and yield were relatively good in most research sites. This is partly due to the more abundant and regularly distributed rainfall. However in some locations plants were severely affected by water run-off, soil erosion, soil insects, termites and magnesium deciency. It was also observed in a lot of farmers fields' serious damage of seedling establishment and plant stands caused by soil insect pests and termites. These constraints should be alleviated in order to achieve the yield potentials of these improved varieties.

These problems deserve careful consideration. In some locations the grains of sorghum S-34 and CS-63 were severely affected by mold and deterioration reducing grain quality). Striga infestation was low and few foliar diseases symptoms were noted.

SORGHUM RESULTS AND INTERPRETATION.

EFFECT OF TIED RIDGES ON SORGHUM GRAIN YIELD AT SEVERAL LOCATIONS OF THE LOWLAND SAVANNA OF NORTHERN CAMEROON.

1. For this experiment, six locations were selected: Makebi, Soucoundou, Bere, Sanguere, Toubor, Kismatari and Guiring. The sorghum varieties used as test crops were: S-35, S-34, CS-61, CS-63. A split plot design was used in these trials.

2. The discussion of the results is summarized in the following sections.

a) As excepted, there was a significant difference in all the research sites - expect at Touboro. In most cases, plots with tied ridges out-yielded those with simple ridges. The maximum yield increases vary according to sites and varieties.

- At Soucoundou: It was up to 1335 kg/ha for S-35 and 890 kg/ha for S-34.

- At Sanguere: it was up to 1042 kg/ha for S-63 and 1043 kg/ha for S-34.

- At Kismatari: it was up to 1042 kg/ha for S-34, and 1056 kg/ha for CS-63.

- At Makebi: it was up to 587 kg/ha, for S-35, and 172 kg/ha for CS-63.

b) Similar trends were reported in other regions of the semi-arid African tropics particularly in tropical ferreginous soils of predominantly sandy texture (alfisol) It was observed, in most plots with tied ridges, better water retention, less run-off, and less damage by soil erosion. Therefore the risks of drought stress were relatively reduced for the sorghum plants in these plots.

c) There was no significant difference between sorghum varieties in all the research sites - except at Soucoundou where S-35 showed a better performance than S-34 (giving an average yield increase of 976 kg/ha over that of S-34). Furthermore, the absolute maximum yield of sorghum S-35 at Soucoundou could be considered good (5.6 t/ha). The variety S-35 seems to have a good potential for this region. The interaction between treatments and varieties was not significant - which would indicate that the effect of tied ridges does not depend on the varieties.

d) The analysis of 1986 data and our observations indicate that tying the ridges every 5m or 7.5m has the strongest impact in most cases resulting in higher yield or net benefit.

e) At Kismatari, the absolute yields were relatively lower than expected. It is probably due to the following reasons: 1) land was fallow for a long period of time before cultivation, 2) there was some insect infestation 3) there were some fertility constraints at that site. The greatest yield response to tied ridges (63% over the check) was recorded here.

At Touboro: There was some yield decline associated with tied ridges. Too much water accumulation at this site may have been responsible for this yield loss.
Recommendations: This study on tied ridges should be continued at more locations and with different dates (early versus late planting) to confirm our results; some on-farm research should be undertaken to evaluate the effect of tied ridges in large scale (1/4 of an hectare).

EFFECT OF TIED RIDGES ON SORGHUM GRAIN YIELD AT SEVERAL LOCATIONS OF THE LOWLAND SAVANNA OF NORTHERN CAMEROON (1986)

TREATMENTS	SANGUERE CS-63 kg/ha	SANGUERE S-34 kg/ha	KISMATARI CS - 63 kg/ha	KISMATARI S - 34 kg/ha	SOUCOUNDOU S -34 kg/ha	SOUCOUNDOU C - 35 kg/ha	MAKEBI S - 35 kg/ha	MAKEBI CS - 61 kg/ha
(Control) Simple ridges	2200	2043	1682	1738	3484	4179	2593	2905
Tied Ridges (every 2.5m)	2690	2721	2002	2155	4133	5124	3180	3077
Tied Ridges (every 5.m)	3034	3086	2293	2780	4374	5319	2702	2752
Tied Ridges (every 7.5m)	2846	2909	2738	2405	4244	5514	3015	3071

AT SANGUERE: F_T = Sig (5%) F_V = N.S. , F_{TXV} = NS ; LSD = 586 CV = 21 %

AT KISMATARI: F_T = Sig (5%) F_V = N.S., F_{TXV} = N.S; LSD = 537 CV = 20%

AT SOUCOUNDOU F_T = Sig (1%) F_V = Sig; F_{TXV} = NS. LSD = 221 CV = 7%

AT MAKEBI F_T = NS F_V = N.S; F_{TXV} = NS; CV = 11%

EFFECT OF SOIL INSECTICIDES AND SEED TREATMENTS ON PLANT ESTABLISHMENTS AND YIELD OF SORGHUM IN THE LOWLAND SAVANNA OF NORTHERN CAMEROON.

Effect of several rates, ways and times of application of soil Insecticides on the performance and yield of sorghum in the lowland savanna.

1. Sorghum varieties used as test crops were S-35 at Guetale and Guiring. The trial at Kismatari was not harvested because the plants were severely damaged by water run-off and soil erosion.

   The results of the trials at Guiring are included in the sorghum agronomy section Furadan 10G is a soil insecticide with carbofuran as active ingredient, and Mocap 10G is a granular soil insecticide with ethoprophos as active ingredient.

   The control plots had seed treated with Titoral (at the rate of 200/100 kg of seed). Thioral - which is used as standard seed treatment by the farmers -is a chemical with 25% TMTH and 25% heptachlore. A RCB design was used in these trials.

2. The discussion of the results is summarized in the following sections.

a) Experimental evidence accumulated in the last two years - as well as our observations in many farmers fields - tend to confirm the finding of the SAFGRAD/IITA team at Burkina Faso on the same subject: soil insects and termites are major limiting factors to increase cereals production in many locations of the savanna of the semi-arid African tropics.

b) Considering all the trials involving soil insecticide and seed treatments on sorghum in which Furadan 10G was used as treatment at Soucoundou, Guetale, Makebi, Kismatari, it is interesting to note that the use of Furadan 10 G at the rate of 10 kg/ha has resulted in substantial yield increase in all cases.

c) At Guetale, as observed last year, the response to applied insecticides was strong and consistent. Yield increase due to insecticide treatments reached up to 1.9 t/ha (44% over the check) with a monetary value of 114,240 FCFA. As observed in the last three years at this location, there was a very severe infestation of termites which damaged sorghum, groundnut and cowpea in the research sites and nearby farmers' fields.

d) The plots treated with Furadan 10 G and Marshal 25 ST gave higher yields than Mocap 10G. In the plots treated with Furadan 10 G and Marshal 25 ST, plants showed good emergence, good seedling vigor and stand with good growth. There was no need for transplanting in these plots. On the average, there was no significant difference between the effect of 10 kg/ha and 20 kg/ha of Furadan 10G. As recorded last year, split application appears to be more effective than single dose application.

e) Between the treatments of Marshall 25 ST (Marshal as seed treatment) and 10 kg/ha of Furadan at post plant, there was a significant difference of 702 kg/ha. The rate of Marshal used in this trial cost 1.400 FCFA (100 g/10 kg of sorghum seeds per hectare). Next year, Marshal will be used at different doses to observe the performance.

f) There seems to be year to year variation in the intensity of soil insect and termites activities, and the resulting damage to crops. The same observation was made in farmers' activities. Although the magnitude of the problem may vary, this constraint is serious enough in many locations. Ways (agronomic or breeding) to alleviate it should be tested.

Recommendations: More research should be undertaken on this matter with sorghum. It will involve multilocational trials with different rates of soil insecticides.

B. EFFECT OF SEED TREATMENT ON PLANT ESTABLISHEMENT AND YIELD OF SORGHUM IN THE LOWLAND SAVANNA.

1. These observational trials were carried out to compare the efficiency of the seed treatment Marshal 25 ST with that of Furadan 10G and Thioral (control) on sorghum performance in several locations of the lowland savanna and to evaluate the varietal response to this treatment.

2. The varieties selected for this test were: S-34, S-35, CS-61, CS-63 and the sites were: Kismatari, Sanguere, Soucoundou, and Guetale.

3. Marshal 25 ST is a seed treatment with 25% carbosulfan as active ingredient (250 gr of active ingredient per kg formulated product). The control plots had seed treated with Thioral (at the rate of 200 g/100 kg of seed). Thioral, which is used as standard seed treatment by the farmers, is a chemical with 25% TMID and 25% heptachlore. A split plot design was used in these trials.

4. The discusion of the results is summarised in the following sections.

a) There was a highly significant difference among treatments in the research sites: Guetale, Soucoundou, Sanguere, Kismatari. There was a strong and consistent response to Marshal 25 ST and the Furadan 10G as compared to the control with Thioral. The highest increase obtained in the treated plots reached 1.3t/ha (40%) at Soucoundou, 1.5 t/ha (535%) at Guetale; 1.9 t/ha (84%) at Sanguere and 1.2 t/ha (592%) at Kismatari. The relatively high response at Kismatari was partly associated to the high degree of infestation of sorghum - plants by termites in this site - which was left fallow during many years.

It is interesting to point out that the response due to the Marshal and Furadan 10G was higher for sorghum than for maize.

b) The plots treated with Marshal 25 ST and Furadan 10G had sorghum planted with good plant density, seedling vigor, a better and faster growth. They reached maturity before the plants in the control plots. No replanting was necessary. The seed treatment Thioral seems not to be effective in case of severe infestation with termites and/or soil insects. On the average, the yield increase due to Furadan 10G was higher than that of Marshal 25 ST. However, it should be pointed out that the cost of Marshal (100 g/ha used as treatments in these trials is about 1.400 FCFA while that of Furadan (10 g/ha) is about 12.000 FCFA. Furthermore, Marshal - which is a seed treatment - is easier to manipulate by the farmers.

As compared to the check, the use of Marshal 25 ST gave an extra yield of 979 kg/ha at Soucoundou, 1055 kg/ha at Guetale, 666 kg/ha at Sanguere, and 833 kg/ha at Kismatari.

c) The interaction treatment X variety was not significant - which would indicate that the impact of the treatment was not dependent on the variety. Finally, our observations tend to indicate that the success of the new varieties selected by IRA, S-34, S-35, CS-63, would be facilitated by the use of good seed treatments in many cases. The problem of low density of sorghum observed in many farmers field may be alleviated with effective seed or soil treatments. Furthermore it would be desirable that the breeder does some selection of varieties on basis of termite tolerance (as it is being done for maize).

5. Recommenuations: More study should be conducted on this subject next year. Other insecticides will be tested, and more sites will be included.

TABLE EFFECT OF DIFFERENT RATES AND TIMES OF APPLICATION OF SOIL INSECTICIDES ON SORGHUM GRAIN YIELD IN THE LOWLAND SAVANNA OF NORTHERN CAMEROON, GUETALE (1986)

TREATMENTS	GUETALE S-35 Yield kg/ha	Yield increase kg/ha	Yield increase %
1. Control	4321	-	-
2. Furadan (X) applied at planting	5331	1010	23
3. " " at 30 DAP	5120	799	18
4. " split (½X) at planting + (½X) at 30 DAP	6201	1880	44
5. Furadan (½X) applied at planting	5928	1607	37
6. " " " at 30 DAP	4825	504	12
7. " split:(1/4X) at planting (1/4X) at 30 DAP	6125	1804	42
8. Mocap (X) applied at planting	4684	363	8
9. " " split: (½X) at planting (½X) at DAP	5247	926	21
10. Furadan (X) split: (½X) at planting (½X) in the whorl	6225	1904	44
11. Seed treated with Marshal 25 ST	5461	1140	26
12. Seed treated with Marshal 25 ST + (½X) Furadan at 30 DAP	6163	1842	43

Furadan (X) = Furadan 10 G at the rate of 20 kg/ha; Mocap (X) = Mocap 10 G at the rate of 15kg/ha.

Marshal 25 ST = is a seed treatment DAP = Days after planting

AT GUETALE: F_T = Sig.(1%); F_{REP} = N.S. ; LSD = 600; C.V. = 11%

EFFECT OF DIFFERENT SEED TREATMENTS ON SORGHUM GRAIN YIELD AT SEVERAL LOCATIONS OF THE LOWLAND SAVANNA (1986)

TREATMENTS	SANGUERE		KISMATARI		GUETALE		SOUCOUNDOU	
	S- 34 kg/ha	CS-63 kg/ha	S - 34 kg/ha	CS - 63 kg/ha	S - 35 kg/ha	CS - 61 kg/ha	S - 34 kg/ha	S - 35 kg/ha
1. Seed treated with Thioral (control)	2291	2332	1291	1458	4193	4415	3353	4019
2. Seed treated with MARSHAL 25ST	2957	2853	2124	1937	5248	5276	4332	4748
3. Seed treated with FURADAN 10G	3999	4290	2478	2358	5498	5942	4698	5081

AT SANGUERE: F_T = Sig (1%) ; F_V = N.S. F_{TXV} = N.S.; LSD = 1062, CV = 30%
AT KISMATARI F_T = Sig (1%) ; F_V = N.S; F_{TXV} = N.S.: LSD = 471; CV = 25%
AT GUETALE : F_T = Sig (5%) ; F_V = N.S. F_{TXV} = N.S.: LSD = 588: CV = 12%
AT SOUCOUNDOU: F_T = Sig (1%) ; F_V = Sig (5%) F_{TXV} = N.S., LSD = 460; CV = 10%

STUDIES OF INTERCROPPING SORGHUM WITH GROUNDNUT IN THE LOWLAND SAVANNA OF NORTHERN CAMEROON:

1. These trials were carried out on a representative tropical ferruginous soil (Alfisol) at Kismatari. The sorghum varieties used were: S-34 and CS-63; the groundnut varieties used were: 55-47 (90 days) versus M-513 - 77 - 1 (115 days). The sorghum/groundnut was planted using a pattern of two rows of sorghum alternating with 5 rows of groundnut. The distance between the sorghum rows 80 cm while the distance between the groundnut rows was 40 cm. A RCB design was used in this trial.

a) The planting pattern used in this trial (two rows of sorghum alternating with five rows of groundnuts) seem to be quite practicial. It facilitated the management operations, like relay planting, weeding, fertilizer application and harvesting. It would be interesting to test these patterns in farmers' fields in different locations.

b) There was highly significant difference among treatments. Yields of monocrop sorghum were higher than those of intercropping sorghum. The same trend was observed for groundnut. These results confirm those obtained in the last three years.

Using the land ratio and monetary value as criteria, <u>monocropping was superior to intercropping</u>. The extra income associated with monocrop sorghum was up to 22.350 FCFA (15%). An interesting remark concerning the intercrop plots: they had relatively less damage by rainfall water run-off and less soil erosion. This fact is important because they are major constraints in this kind of sandy soil (Alfisol).

c) Regarding monocropping there was no significant difference between both varieties of sorghum or both varieties of groundnuts. Regarding intercropping, the best association appears to be sorghum CS-63 with groundnut M-513 - 77 - 1.

Recommendations: Study on intercropping sorghum/groundnut should be continued at several locations next year to confirm the results obtained at Kismatari.

INTERCROPPING EXPERIMENT WITH SORGHUM AND GROUNDNUT IN THE LOWLAND SAVANNA, KISMATARI (1986)

	TREATMENTS		CROP YIELD (kg/ha)					MONETARY VALUE (CFA F)		
			SORGHUM		GROUNDNUT			SORGHUM	GROUNDNUT	TOTAL
	Sorghum	Groundnut	(X)	(kg/ha)	(Y)	(kg/ha)	(Z)			
1.	S-34 +	55 - 437	0.50	1 088	0.39	613	0.89	76 160	49 040	125 200
2.	CS-63 +	55 - 437	0.43	1 021	0.39	608	0.82	71 470	48 640	120 110
3.	S-34 +	M513 - 77 - 1	0.53	1 165	0.34	588	0.87	81 550	47 040	128 590
4.	CS-63 +	M513 - 77 - 1	0.58	1 398	0.34	593	0.92	97 860	47 440	145 300
5.	S-34 (monocrop)	-	-	2 187	-	-	-	153 090	-	153 090
6.	CS-63 (monocrop)	-	-	2 395	-	-	-	167 650	-	167 650
7.	-	55 - 437 (monocrop)	-	-	-	1 576	-	-	126 080	126 080
8.	-	M513 - 77 - 1 (monocrop)	-	-	-	1 737	-	-	138 960	138 960

(X) = L.E.R (Sorghum); (Y) = L.E.R (Groundnut); (Z) =(Total) ; L.E.R = Land Equivalent Ratio

AT KISMATARI: For Sorghum: F_T = Sig.(1%); LSD = 378; C.V.=23% Sorghum: 70 F CFA/kg

For Groundnut: F_T Sig. (1%); LSD = 348; C.V. 34% Groundnut: 80 F CFA/kg

TASTE TEST WITH IMPROVED SORGHUM VARIETIES.

(A) <u>Results for sorghum CS-61</u>

A TOTAL OF 81 Families participated in the preliminary test with sorghum CS-61, 97% stated they liked it very much while 3% liked it a little. At Makebi, out of 35 families who participarted, 94% liked CS-61 very much, 6% liked it a little. At Guetale, all the 46 families who participated in the test stated they liked CS-61 very much. They requested the seed to plant in their farms next year.

(B) <u>Results for sorghum S-35</u>

At Soucoundou, out of 20 families who tasted S-35, 90% stated they liked it very much while 10% liked it a little.

(C) <u>Results for Sorghum S-35</u>

Out of 51 families who tasted it, 47% stated that they liked it very much; 30% liked it a little and 23% did not like it at all.

At Soucoundou, out of 20 families who participated in the taste test, 50% liked it very much 30% liked it a little and 20% did not like it at all.

At Touboro, out of 31 families who tasted S-34, 87% liked it very much, 10% liked it a little and 3% did not like it.

The test with S-34 could not be extended to more families because part of the grain harvested at several locations was affected by mold which affect negatively the color and the taste of this variety.

T L U   B A M B U I

I N T R O D U C T I O N

The TLU at Bambui is the original TLU in the NCRE Project. It has been in the field since 1981, and has worked through five complete cropping seasons. During this time, the concept and goals of the unit have undergone some natural modifications, in response to changing circumstances, both within IRA and in the Extension Service in the North West and West Provinces.

Originally, the TLU was mandated to train extension staff of the Ministry of Agriculture, carry out on-farm demonstration/trials, and create linkages between research (IRA) and other agencies working in the field of agricultural research/extension/development (MINAGRI, Parastatals, Projects, etc.).

With the coming of MIDENO, which had a clearer mandate and better facilities to train extension staff, the TLU turned its attention almost entirely to on-farm research and the generation of farmer recommendations. Since 1983, the TLU has implemented hundreds of on-farm trials, testing improved maize and rice varieties, fertilizer response, and modifications in cropping patterns. In the process, a close working relationship has been created between the TLU and MIDENO, PDA, UCCAO and UNVDA.

As of the end of 1985, the TLU had clearly identified new varieties of maize and rice that were proven to be superior to locally grown varieties in several distinct agro-climatic zones in the Western Highlands, in terms of yield and disease resistance. In addition, the new varieties, in general, were found to be accepted, with few reservations (mainly storability), by farmers. However, information gaps still remained; for example, the optimal N and P levels for maize and rice, and the optimal density of maize when intercropped with groundnuts or beans.

The major constraints faced by the TLU in past years have been those of logistical nature. On-farm research requires adequate personnel (researchers and junior technicians); reliable vehicles, capable of reaching the research sites (i.e., 4-wheel drive and rugged); and funds for fuel, research supplies, and out-of-station allowances.

In 1986, the greatest constraints were a shortage of research personnel and technicians on the ground, and a lack of adequate vehicle support. These will be remedied eventually with the return of the national counterparts from the U.S. (projected for 1988-89), and the purchase of Toyota 4-wheel drive vehicles in 1987.

METHODOLOGY AND OUTPUT

In 1986, the TLU looked at fertilizer [Nitrogen (N) and Phosphorus (P)] and plant density response in a maize/grain legume intercrop, and tested new irrigated rice varieties in an area new to research (Mbaw Plain).

Maize/Groundnut (Beans) N x P Trials were set out in 14 locations in 4 agro-climatic zones. In each trial, three levels of N (0, 75 and 150 kg/ha) and three of P (0, 60 and 120 kg/ha) were applied in all possible combinations (full factorial) to a maize/groundnut or maize/bean intercrop. An additional treatment was added to represent the current IRA recommended rate (60N - 30 P). The sources of N and P were urea (46% N) and Single Super Phosphate (21% P_2O_5), respectively. The treatments were replicated 4 times at each location, allowing for independent analyses ("Site Specific Trial" as per Hildebrand and Poey, 1984).

Despite generally low measured available P in the soils (see Table 1), there was no significant response to phosphorus except in Bali and at the one site in the Bamenda Plain (Table 2-4). This may reflect strong P fixation by the soil or micronutrient deficiencies. The maize yield response to N, however, proved significant at all sites but one, and can be applied economically to a level of 150 kg N per hectare, although limited cash considerations would suggest a lower recommended rate for most farmers.

Maize/Groundnut Cropping Pattern Trials were implemented on 21 farms in 3 zones, to estimate the effect of changing maize plant population on the yields and economics of the intercrop. Maize was planted at 3 densities (26,666, 40,000, and 53,333 plants per hectare), with and without fertilizer (400 kg 20-10-10 compound fertilizer per ha). Sole crop treatments were included to allow for the estimation of land equivalent ratios (LER). With only two replications per farm, the results were pooled for analysis in each zone.

Maize dominates associations with groundnuts in the mid-altitude zones in Western Cameroon with as much as 30:1 yield ratios; and therefore, in economic terms, as maize responds, so responds the intercrop. In the TLU trials, maize yield responded strongly to fertilizer at all plant densities. However, increasing plant density to the highest level only benefited yields when the maize was fertilized. That means that the optimal maize density changed with the fertilizer regime. With no fertilizer, the medium density (40,000) was optimal. With fertilizer, the higher population (53,333) was marginally better than the medium population (Tables 5 & 6).

Maize Trial Minikits were distributed to Village Extension Workers (VEW) for the fourth year running. Each kit consisted of materials necessary to carry out one single replication trial, in which a new (IRA) maize variety was compared with the farmer's own variety, with and without fertilizer, under farmer management. Maize varieties tested included: COCA, BACOA, MLC, PH 290, Kasai I, Ekona White and Ekona Yellow. The 400 minikits distributed in 1986 brings the total, since 1983, to 1550.

In addition to yield estimates, the minikit trials provide feedback from a large number of farmers on varietal preference and production problems. The trend of past years was repeated with 75% of the participating farmers preferring the new maize varieties to their own ("Local") variety. Preference ratings ranged from 72% for MLC to 100% for Ekona Yellow (Table 7).

Fertilizer (300 kg 20-10-10 per ha) applied to the local variety increased maize grain yields by an average of 750 kg/ha; whereas, merely switching from the "Local" to the "Improved" variety increased yield by 590 kg/ha. The mean yield increment for switching to the "Improved" variety and applying fertilizer was 1,270 kg/ha, or a 65% increase over the "Local" variety without fertilizer. For those farmers who already apply fertilizer to their "Local" maize, planting the "Improved" variety improved yields by an average of 520 kg/ha (19%).

The most common production problems encountered by farmers during the trial were birds (65% of farmers responding), stem borers (33%), soil fertility (32%), animals (25%), thieves (21%) and lodging (19%).

Exploratory Irrigated Rice Variety Trials were carried out with the assistance of VEW's in the remote Mbaw Plain; where no previous research has been done on rice since its introduction in 1975. Five new rice varieties (CICA 8, CISADANE, ITA 222, ITA 212 and IR 3273-339-2-5) were tested alongside the local cultivar in one replication trials on 10 farms. All varieties received 400 kg 20-10-10 per ha. Paddy yields were estimated and the participating farmers asked to rank the varieties in order of preference.

Yields ranged from 2.7 tons/ha ("Local") to 3.7 tons/ha (CICA 8) (Table 8). The highest mean preference ranking went to CICA 8 (1.7) and the lowest to "Local" (2.7). A great deal of interest was generated among farmers in the Plain, and the trial will be repeated in 1987.

GENERAL STATEMENT

At this point, the TLU has begun to piece together some of the critical production factors facing maize and rice farmers. Emerging information on varietal performance, fertilizer response and cropping patterns will permit the TLU to integrate several factors, with fewer treatments, in future trials in pursuit of more complete recommendation packages. In fact, the 1987 research program calls for an operation that tests maize variety, nitrogen, phosphorus and plant density in one trial.

Summary Tables for TLU-Bambui On-Farm Trials. (Details are to be found in the IRA-Bambui Station Annual Report)

Maize/Groundnut (or Beans) N x P Trials.

Table 1: Some Physical and Chemical Characteristics Soils Collected from TLU On-Farm Trial Sites

Site	Soil Separates Sand	Silt	Clay	Texture	pH	Organic Carbon	Avail P*
	(%)	(%)	(%)			(%)	ppm
Eastern Highlands:							
Mbiyeh	64	24	12	Sandy-Loam	5.4	2.1	0.5 very low
Dzeng	66	24	10	Sandy-Loam	5.3	2.4	0.9 very low
Kitiwum	64	22	13	Sandy-Loam	4.8	1.9	3.5 low
Wvem	60	26	14	Sandy-Loam	5.4	6.9	0.2 very low
Ndop Plain:							
Mabim	53	19	28	Sandy-Clay-Loam	4.8	2.6	7.5 medium
Babessi	71	18	11	Sandy-Loam	5.6	3.5	36.9 high
Bamali	70	14	16	Sandy-Loam	5.7	2.6	69.4 very high
Babungo	52	27	20	Loam	5.4	2.3	1.3 very low
Bamenda Plain:							
Nkwen	63	13	24	Sandy-Clay-Loam	4.9	3.2	3.5 low
Santa	60	24	16	Sandy-Loam	5.5	5.8	1.8 very low

* Bray-1: <3 ppm=very low; 3-7=low; 7-20=medium; >20=adequate to high (Analysis courtesy of NCRE Rice Agronomist, IRA-Dschang.)

Table 2: Mean Maize and Bean Yields (NxP Response - Wvem, NWP)

N-Level	Maize	Beans	P-Level	Maize	Beans
(kg/ha)	(kg/ha)	(kg/ha)	(kg/ha)	(kg/ha)	(kg/ha)
150	4399 a*	371 a	120	3444 (NS)	303 (NS)
75	3738 a	332 a	60	3690	261
0	2535 b	206 b	0	3538	345
Range	1864	165		246	84
LSD (5%)	788	83			
CV	26 %	33 %			

* Mean yields having the same letter are not significantly different at the 5% level.

Table 3: Maize Yield Response to Nitrogen (3 Farms, Ndop Plain)

N-Level	F A R M E R Salifo		Ndifor		Nabonse
(kg/ha)	(kg/ha)		(kg/ha)		(kg/ha)
150*	7757	a	7623	a	4441**
75	6959	b	7129	a	4617
0	3857	c	3748	b	3203
Range	3900		3875		1414
CV	9 %		16 %		24 %

* Yields averaged across all Phosphorus levels. P not significant.
** Yields estimated by regression for this location.

Table 4: Maize Yield Response to N and P (3 farms, Bali)

Treatment	Mean Maize Yield	DMRT (5%)
N - P	(Kg/Ha)	
150 - 0	2,363	a
150 - 60	2,335	a
75 - 120	2,063	ab
75 - 60	1,947	bc
60 - 30	1,711	bcd
150 - 0	1,623	cde
75 - 0	1,472	def
0 - 120	1,273	efg
0 - 60	1,142	fg
0 - 0	1,063	g
Range	1,300	
LSD (5%)	368	
CV	27 %	

Maize-Groundnut Cropping Pattern Trial.

Table 5: Mean Maize Yield, Groundnut Yield and Income Equivalent Ratio (IER), by Maize Plant Density.

Zone	Fert (+/-)	Planted Maize Density 53,333	40,000	26,666
Bamenda Plain:				
Mean Maize Stands		51,600	40,902	28,627
Maize Yield	+	5237	4629	4137
	-	1762	1606	1742
G'nut Yield	+	161	158	217
	-	198	239	262
IER	+	3.63 (1.36*)	3.25 (1.24)	3.13 (1.29)
	-	1.65 (1.06)	1.68 (1.06)	1.68 (1.16)
Ndop Plain:				
Mean Maize Stands		51,667	40,467	26,750
Maize Yield	+	5635	6667	5576
	-	2948	3450	2636
G'nut Yield	+	142	194	196
	-	167	124	129
IER	+	3.81 (1.23)	4.58 (1.51)	3.93 (1.34)
	-	2.27 (1.19)	2.44 (1.26)	1.97 (1.03)
West Province:				
Mean Maize Stands		52,978	41,167	26,667
Maize Yield	+	5882	5630	4508
	-	1537	2366	2133
G'nut Yield	+	118	130	154
	-	127	175	143
IER	+	3.88 (1.44)	3.77 (1.43)	3.17 (1.31)
	-	1.30 (0.87)	1.94 (1.28)	1.71 (1.12)

* Numbers in parentheses are LER's.

Table 6: MRR for undominated Intercropped Maize Treatments

Treatment		Variable Costs	Net Benefit	MRR
		CFA/Ha	CFA/Ha	%
53,333 plts/ha	+ F	43,500	265,486	
				92 %
40,000	+ F	42,250	264,333	
				2712
26,666	+ F	41,000	230,429	
				338
40,000	- F	16,250	146,842	
				1052
26,666	- F	15,000	133,692	

Maize Minikit Trials.

Table 7: Mean Maize Yields for Minikit Trials, by Variety

Variety		N	Improved Mean Yield	Local Mean Yield	Variety Yield Increment	% Farmers Preferring Imp. Var.
			Kg/Ha	Kg/Ha	Kg/Ha	%
EKONA YELLOW	- F	9	2600	1922	678	100 %
	+ F		4383	2375	2008	
Fert. Yield Increment			1783	453	2462	<-Tot Increment
EKONA WHITE	- F	10	2601	1450	1151	88
	+ F		3640	2574	1067	
Fert. Yield Increment			1039	1124	2191	<-Tot Increment
COCA	- F	22	2777	2061	716	83
	+ F		3554	2653	901	
Fert. Yield Increment			777	592	1493	<-Tot Increment
PH290	- F	17	2274	2265	9	76
	+ F		2752	2824	- 73	
Fert. Yield Increment			477	559	486	<-Tot Increment
BACOA	- F	23	2315	1793	522	75
	+ F		2872	2599	273	
Fert. Yield Increment			557	805	1079	<-Tot Increment
KASAI I	- F	27	2621	2112	509	72
	+ F		3424	2888	536	
Fert. Yield Increment			802	775	1311	<-Tot Increment
MLC	- F	27	2676	1924	752	72
	+ F		2813	2790	23	
Fert. Yield Increment			136	866	889	<-Tot Increment
All Improved	- F	135	2547	1959	587	75
	+ F		3227	2708	519	
Fert. Yield Increment			680	749	1268	<-Tot Increment

Exploratory Rice Variety Trials in the Mbaw Plain.

Table 8: Rice Yields & Preference Ranking, by Variety (Mbaw Plain)

Rice Variety	Mean Grain Yield (Kg/Ha)	Mean Preference Ranking
CICA 8	3692	1.7
CISADANE	3418	1.9
ITA 212	3326	2.0
IR3273-339-2-5	3100	2.4
ITA 222	3358	2.4
Local	2671	2.7

FLU EKONA

I. INTRODUCTION

The Ekona FLU is responsible for on-farm food-crop testing (of roots and tubers as well as maize) and farmer-MINAGRI (extension)-IRA Liaison in two provinces, South West and Littoral. It must further supply its own on-station support for maize seed and agronomic trials, as IRA-Ekona has no other Cereals staff. Such multiple duties need multiple researchers, and the Unit began full functioning with two Cameroonians and two NCRE expatriates in mid-1986. The expatriate agronomist died four months after arrival, before the agronomic program was fully defined or the Cameroonian staff, researchers or technicians, adequately initiated into the methods needed to achieve the new elements in it. Outputs from this part of the program were less than hoped in quantity and quality.

1986 was devoted to infrastructural, methodological and organizational activities designed to prepare the unit for full functioning in 1987, plus the completion of the first of nine agro-socio-economic surveys, one for each administrative region within the two provinces. The Fako survey and related reconnaissance showed that IRA cassava and especially maize technology might have unexpectedly high local payoffs, although the greatest farmer priorities were cocoyam and plantain epidemics for which IRA cannot yet provide solutions. It provided key cropping data and farmer and extension contacts for the design and execution of 1987 on-farm trials of maize and cassava technology. At the same time, recommended maize varieties were multiplied for testing, pilot market and farmer yield surveys were undertaken, on-station intercropping and density trials were continued or initiated, and IRA and MINAGRI staff were trained.

Constraints attacked in 1986 were :

- Information (lack of knowledge of food-crop farmers' circumstances, priorities and potentialities in coastal Cameroon);

- Infrastructural (lack of support staff, office equipment, storage space and equipment, field equipment, computer maintenance and software);

- Methodological (insufficient experience of IRA researchers and/or technicians with farming systems research, farmer surveys, agronomic design and analysis); and

- Organizational (overlapping and confusion of off-station responsibilities between IRA-Ekona sections, little organized or extensive contact with MINAGRI extension staff).

II. Outputs

Sub-goals	Methods	Outputs
A. Research		
1. Agro-socio-economic base-line survey of Fako food-crop farmers	+ eco-zone mapping + rapid reconnaissance + formal survey + statistical analysis by region and zone	+ Farming Systems Survey of Fako Division, South West Province + cropping patterns for 1987 on-farm trials design + farmer/village/extension contacts for OFT work + training in data collection and analysis for IRA researcher & technician + data on extent of crops, use, disease, storage, inputs for IRA researchers & agric. planning - (neg.) recon cut short by death
2. Market survey (pilot)	+ bi-weekly visits to 10 markets (3 mos.) for price & weight recording + analysis of variance by time of day, month & market + comparison with baseline survey data	+ prices vary predictably by month but little by time of day; only local, unprocessed crops varies by market + no standard weights used, volume units of most produce vary across sellers + market survey data superior to farmer survey for ascertaining crop prices for econ. anal. + pilot survey method too costly in staff and transport
3. Agronomic trials on-station	+ maize/groundnut rotation trial + maize/groundnut intercrop trial + stands density trial	+ trial has one season to go + intercrop patterns found atypical of region, ill-adapted; trial abandoned before final season + eaten by birds three times; replanted 1987
4. On-farm yields survey (pilot)	+ weighing & identification of all produce from sample plot of 5 farmers' fields in 3 zones + yields calculations	- insufficient farms chosen per major ecozone for confidence in results + extremely low maize yields (.2-1.8t/ha) and densities (5000-25000 pph) found under inter-crop, density inverse to yield

B. General

1. Infrastructure (support staff, office, storage, field equipment, computer)	+ internal shifting of resources + purchase	+ assignment of 2 technicians, 1 recorder and senior technician to Unit + hiring of 3 drivers and 1 typist + 1 NCRE and 1 IRA project vehicle acquired + office and some storage space acquired and equipped + sprayers, hoes, cutlasses, tapes, scales, chemicals etc. purchased + Ekona computer maintained and software for survey analysis purchased
2. Methodological training (farming systems, survey, agronomic trial)	+ team development of research protocols + collaboration in recon, survey and trials between IRA & NCRE staff + advice on degree thesis research	+ protocols becoming more specific and regionally focussed + IRA's economist's increased capability in field surveys, devel. of PhD research + IRA technician's training in survey management - interruption of IRA agronomist's & technicians' training by sr. agr.'s death
3. Organization (within IRA and MINAGRI links)	+ IRA-Ekona guidelines on TLU responsibilities + visits to Fako/Meme/SWP MINAGRI officials + training course IITA/IRA-/MINAGRI roots & tubers + on-farm-trial workshop for Fako/Meme MINAGRI	+ internal administrative guidelines enabling TLU to operate effectively between Ekona researchers & MINAGRI + identification of collaborators for OFT program + training of 29 technicians in root & tuber technology + introduction of 27 MINAGRI staff to OFT methods & IRA maize program
4. Consultants	-	- none scheduled from outside; within Cameroon Drs. Empig (maize, NCRE/IRA) and Abaka Whyte (cassava, IITA/IRA) provided help

5. Professional Improvement	+ NCRE/IRA field tours of North and North West/West + IDRC/IRA farming systems field tour Yaounde + IRA Annual Farming Systems/Cereal Review	+ learning about IRA agronomic work elsewhere + methodological suggestions for survey work + guidance for 1987 OFT program
6. Publications	-	

III. General Statement

The TLU at Ekona entered the 1987 agricultural year with a much improved base from which to carry out its mandate for on-farm testing and liaison in a farming systems framework. Improvements are still needed in physical infrastructure (especially storage, drying, computer and office space) and will continue to be made throughout the program in methodology and organization. The first baseline survey and training exercises were carried out successfully and other pilot surveys and trials helped to define methodology and goals for the 1987 on-farm trial program and future baseline, marketing and other surveys. These will be able to be carried out more efficiently and extensively in 1987 and beyond. The major continuing constraints, beyond the current IRA budgetary problems, are the lack of researchers (aggravated for the first season of 1987 by the effective absence of both IRA researchers on leave) and vehicles. Because of the expectations among farmers and MINAGRI, raised by the survey and training courses, the TLU has opted to concentrate its scarce resources (researcher/vehicular) on the on-farm trial program for first season. Three researchers (two NCRE and one IRA) are expected to be available second season to carry out a normal program.

Annex: Data: Farming Systems Survey of Fako Division

A. Agro-ecological subzones

Subzone Number	[illegible]	2	3	4	5	6	7	8
Descriptive	Well-drained sand	Forest volcanic (Stranger)	Badly drained sand	High volcanic	Mid volcanic	Low volcanic	Forest volcanic (Native)	High-rainfall volcanic
Soils	Typic Paleudults (clayey)	Andic Humitropepts	Arenic Paleudults	Typic Dystrandepts (medial skeletal)	Andic Tropohumults to Fluventic, Typic Humitropepts (clayey)	Typic Humitropepts (clayey skeletal)	Typic Dystrandepts (medial skeletal)	Typic Hydrandepts (medial)
Altitude (m)	0-100	100-400	0	600-900	300-600	0-300	300-800	0
Rainfall (mm)	1700-2000	2000-4000	3000-5000	2500-3500	3000-3500	2000-3000	3500-4500	5000-9000
Fallow*	short	long	mid	long	mid	short	mid	mid
Ethnic type**	mixed	NW/W	mixed	Native	NW/W	NW/W	Native	Native
Farm families***	1400	850	620	1080	[illegible]	3100	370	650
Surveyed families	20	20	14	10	[illegible]	30	10	15

* ratio between fallow time and interim cultivation for long-established fields, or frequency of replacement of rented fields
** NW/W: first to fourth generation immigrants from North West and West Provinces (highlands)
*** estimated from comparison of tax rolls with farmer lists in sampled settlements

Interpretation: There are eight agro-ecological subzones distinguished by rainfall, altitude, soils and ethnicity. Different subzones have specific agronomic problems (eg soil pests in subzone 2, speargrass in subzone 3) and preferences (eg monocropping maize in subzones 5 and 6, or cassava in 7), but the population sizes do not justify treating them separately in individual testing programs. In terms of crops grown and cropping problems reported and observed, subzones 1 and 3 cohere as a "Sands" zone with 2020 farming families, and 2, 5, 6 and the lower part of 7 as a "Lower Volcanic" (L/V) zone (7035 families). The upper half of subzone 7 under this classification fits better with 4 as a small "Upper Volcanic" (U/V) zone with 1265 farmers, and subzone 8 ("West Coast", or WC) remains alone with 650 families, due to the extreme lodging, leaching and disease problems caused by the high rainfall. The justification for retaining West Coast is the assumed representativeness for parts of neighboring Ndian Division.

Recommendations for 1987: major on-farm trial programs in L/V and Sands; smaller programs tailored for U/V and WC.

Fallows:
Interpretation: "Short" fallows are those in which the land is used for more years than it is rested in each cycle (usually 3-5 and 2-3). "Mid" fallows are those in which each phase of the cycle is roughly equal. In the L/V and U/V the soil is sufficiently rich to make "short" fallows a viable option in the present generation. In the Sands and WC it is not, and fertility problems can easily be discerned near settlements.
Recommendations for 1987 and beyond: investigate methods for developing a continuous cropping strategy for the Sands (nitrogen fixation, organic matter, erosion control).

B. Crops Grown by Farmers, by Zone (those considered by them to be the principal ones in the field) (weighted for population)

Zone	Sands	L/V	U/V	WC	Fako
Major crops (% farmers)					
plantain	56	83	74	60	76
cocoyam	44	61	100	60	60
maize	40	65	23	20	55
cassava	95	47	0	73	55
taro	2	35	20	20	27
yam	22	15	63	27	20
groundnut	22	25	0	0	20
cocoa	21	50	0	20	40
coffee	9	46	43	0	36

Interpretation: Each zone puts a different priority on the major crops. The Sands and WC emphasize cassava, and have few cash (tree) crops. L/V emphasizes plantains, but is more diverse than any other, and has the most tree crops. The U/V focusses the farm on cocoyams, also growing much plantains, maize and coffee. At present, maize is most important in the L/V and Sands zones. Maize fields observed in the L/V were the most productive, followed in decreasing order by the U/V, Sands and WC. Yams are only of major importance in parts of the U/V. Young tree crops are rarely intercropped. Legumes, including groundnuts, are not common.

Recommendations for 1987: concentrate on plantains, cocoyams, maize and cassava (but see below). Ignore influence of tree crops except as Cooperatives channel.

C. Perceived field losses of crops (weighted for population)

Zone	Sands	L/V	U/V	WC	Fako
Field losses reported (as % of expected crop):					
maize	22	23	12	14	22
cassava	13	5	na	23	8
cocoyam	25	28	42	45	30
plantain	14	19	47	58	22

Interpretation: These perceptions by the farmers are a combination of real productivity gaps and their expectations about what a normal harvest is. The U/V and WC report few losses of maize, yet U/V ears tend to be small and WC fields experience much lodging and disease. Maize losses are attributed to borer, stunting and other pests primarily. Cassava losses are low, although yields of local varieties on IRA station tests are a third of IRA ones. Reports of cocoyam and plantain losses are more reliable as the farmers have not yet become accustomed to the effects of the root rot and black sigatoka diseases. Often fields affected produce almost nothing. There is no technology yet existing to reduce these two diseases that is economically available to small farmers.

Recommendations for 1987: eliminate plantains and cocoyams from trials. Establish careful observation of diseases and pests in maize trials to clarify their role in lowering yields. Test IRA maize and cassava cultivars against local ones under farmer conditions.

D. Input use in food crops (weighted for population):

Zone	Sands	L/V	U/V	WC	Fako
% farmers using:					
fertilizer	4	13	9	0	10
manure	2	8	11	13	7
purchased maize seed	68	38	48	89	46

Interpretation: Fako farmers use few industrial inputs on food crops. Only a few, mostly around IRA station fields, use fertilizer, half using an inappropriate one. Fewer have ever used an insecticide or herbicide, or manure. Appropriate chemicals other than 20-10-10 fertilizer are difficult to obtain. Only one farmer in 124 had IRA maize seed (acquired several years before), two had IRA cassava clones and four, sweet potato clones. Yet half buy their maize seed each season from the food markets.

Recommendations for 1987: avoid use of insecticides in trials. Use locally available fertilizer and analyze economics of its use in the different zones. Investigate further why fertilizers are used on tree crops but rarely on annuals. Investigate the origin of market maize seed and collect samples for comparison. Make IRA maize and cassava widely available in small test kits with Extension follow-up.

E. Sexual division of labour:

Zone	Sands	L/V	U/V	WC	Fako
% food fields weeded only by:					
women	55	25	30	15	26
men	15	20	30	45	23

Interpretation: farming food crops is an integrated activity in Fako. In all zones some women farm with little help from men, some men with little help from women, and some couples farm together; all usually with children. Men usually do the clearing if present.

Recommendation: do not exclude either sex from surveys or trials. (In fact, the extension agents work easily with both.)

F. Cropping patterns for maize and cassava (by field):

Zone	Sands	L/V	U/V	WC	Fako
Fields in which maize is a major crop:					
intercropping:					
no other major crop	5	60	40	0	47
plantains	15	10	0	0	12
cocoyam/taro	15	25	40	100	26
cassava	95	10	0	100	31
groundnut	35	10	0	0	14
All maize fields:					
% grown on flat:	70	100	95	80	93
mean seeds/hole:	3.3	3.2	2.9	3.1	3.2
mean density (1000 pph):	27	44	69	43	39.5
Fields in which cassava is a major crop:					
intercropping:					
no other major crop	50	50	na	40	42
plantains	15	30	na	25	23
cocoyam	15	35	na	5	24
maize	40	15	na	15	18
% grown on flat:	25	45	na	100	46
density (1000 plants/ha)	10	8	na	5	8

Interpretation: when maize and cassava are planted as major crops, they are often monocropped, or planted with a scattering of secondary crops. (Maize is almost as often planted as a secondary crop as major.) Principal intercrops for maize are cocoyam and cassava (the latter principally on the Sands and WC), and for cassava, plantains, cocoyams and maize (the latter principally on the Sands). Groundnuts are intercropped only on the Sands. Most maize is planted on the flat, in stands of 2-4 stalks; usually 1-2 survive to maturity although thinning is not common practice. Cassava is most often planted on mounds, 1-3 stakes per mound, but also often on the flat except in the L/V. Maize densities at planting vary widely, from 5.000 to 250.000 plants per hectare, but average 40.000; station recommendations for monocrop are 50.000, and 30-40.000 for intercrop with cassava. Cassava densities average 8.000 but range from 500 to as much as 28.000 plants per hectare, the station recommendation being 10.000 under monocrop or intercrop.

Recommendations for 1987: because of the cocoyam and plantain diseases, trials should be restricted to maize-cassava intercrops or monocrops. In the Sands and WC the intercrop option is preferable; in L/V monocrop; in U/V monocrop (maize only). No single density will approximate the practices of the majority of farmers in any one zone, so station recommendations (which are close to the mean survey densities) will be used. Cassava will be planted on mounds and maize on flat. Station maize-groundnut intercrop trials should be retargeted.

T L U - NKOLBISSON

I N T R O D U C T I O N

Research on farmers' fields within the framework of Testing and Liaison Unit's activities commenced during the second half of 1986 in Nkolbisson. Reconnaissance tours with visits to farmers' fields were undertaken in Akonolinga, Monatele, Ntui and Sa'a in the Centre Province, and Sangmelima in the South Province. The aim of the these field tours was to identify potential areas that will broadly reflect the general features of the lowland forest for On-farm research, and secondly, to obtain exposure to the general farming systems in the mid-altitude and derived Savanna zones, where TLU-Nkolbisson is mandated to cover. The Ntui Subdivision, which is in the transion zone and offers a wider variation of systems, was selected as the region to begin on-farm research, and spreading into the other regions in subsequent years as experience is accumulated. It was chosen with due considerations given to accessbility; some knowledge being available about its 52 villages; fairly typical for a large proportion of mid-altitude zone; reflects rural character, and there is IRA presence on MIDEVIV station, thus allowing easy comparison of station and on-farm results.

Some major constraints limiting food production were evident through field visits and informal discussions with farmers and other knowledgeable people in agriculture. These include incidence of stem borers and streak on maize, particularly, in the minor season (Aug-Nov); low soil fertility (eg. nitrogen, phosphurus and sulphur) and plant population; cassava root rot; high weed infestation eg. Chromolaena odorata and Imperata cylindrica, and lack of crop genotypes adapted to farmers' conditions. Other bottlenecks in the agricultural production are scarcity of labour especially for land clearing in the forest, lack of storage facilities and infrastructure for marketing produce.

WORK PLAN

GOAL : To identify acceptable materials and practices that will enhance the productivity of resource poor farmers in the lowland forest of Cameroon.

SUB-GOAL	METHODS	OUTPUT
1. Selection of regions sites and cooperating farmers for on-farm research.	Field visits and informal surveys; Discussions with farmers and extension staff.	Contacts will facilitate on-farm research.
2. Identify food production problems and constraints on farmers' fields	On-farm exploratory trials and analysis of exploratory survey reports.	Aid in designing future on-farm trials tailored to farmer's problems.
3. Establish linkages with Extension staff and national organization eg. MIDEVIV.	Render visits to various national organizations	Facilitate the design of on-farm trials and diffusion of technological packages.

GENERAL STATEMENT

The team established preliminary contact with the Ntui Sub-divisional delegate and MIDEVIV, and both enthusiastically showed interest in cooperating with the team in putting up joint trials and demonstrations on farmers' fields. Over twenty farmers also agreed to participate in TLU's activities in the two villages (Biatsota II and Ossombe in the Ntui subdivision) the team is operating in. Another notable success was the departure of - Mr.Jupiter Ndjeunga for further studies in the United States, and his replacement by Mr. George Dimithe. However, the team operated with a few major problems. For example, there is no field technician and/or recorder attached to TLU on-farm activities, thus limiting the team's activities. The absence of a senior socio-economist in the team and the lack of storage space for research equipment have been of some concern to the team.

Conferences/Workshops attended

- All African Governmental consultation on Striga control workshop held in Maroua, Cameroon in October 20-24, 1986.

- IRA-IITA-IDRC workshop on On-farm Research held in Nkolbisson in December 10-11, 1986.

RESULTS ON FIELD VISITS

The production systems in all places visited are fairly similar, and fallow systems dominate the agricultural production. Variation in the systems are related to climate, access to land and insfrastructure. Long duration fallows are opened up by tree felling with chainsaws and seeded with the climbing melon, NGON (Cucumeropsis manii). After "ngon", the land is cleared from the remaining vegetation, burnt and planted with groundnuts in association with maize, cassava, cocoyam, plantain and a number of vegetable types (onion, okro, amaranthus, water leaf). Cocoa is the major cash earner, and coffee (Robusta) and oil palm are of some economic importance.

ON-FARM TRIALS

Preliminary on-farm trials were conducted using the farmers' contacts established by the IDRC team in Bikok and Ebakowa about 50 km South of Yaounde. Earlier on-station studies on cropping pattern indicated that planting groundnuts between two rows of maize spaced 1.6 to 2.0 m produced the best maize and groundnut yields. This was tested on farmers' fields in the first season by the IDRC team. Generally, the farmers liked the idea of row planting facilitating operations, such as weeding, but thought maize spaced 2 m apart was narrow and could shade the groundnut.

A trial was then conducted to compare maize spaced 2 m apart with that spaced 3 m in maize/groundnut/cassava intercrop. Maize was harvested fresh as requested by the farmers and also mostly consumed as such in the area. Generally, there tended to be no significant differences between spacing on maize yields (tables 1 and 2). But the local maize yield was significantly higher than the improved maize under heavy infestation of stem borers (table 1). This was observed on both farms. The local maize appeared less attacked, and it could be because of escape or preferrence or exhibiting some tolerance to borers attack. However, seeds of the local maize have been given to the maize breeder to verify this. The improved maize performed better than the local maize where the infestation of stem borers was relatively less severe (table 2). The results of these studies show that improved maize will require some external inputs on farmers' fields under severe conditions of pest infestation and low soil fertility.

There were no significant differences in groundnut yields due to the associated maize variety (tables 1 and 2). The effect of maize spacing on groundnut yields was not pronounced, although there were slight yield increases in groundnut associated with maize spaced 3 m apart. This was significant on one farm (table 1). These results need to be confirmed in further studies.

Researcher-managed alley cropping trial was established on a farmer's field to study the effect of Leucaena pruning on the growth and performance of component crops in a maize/groundnut intercrop. The maize yield from the treatment receiving leucaena prunings was significantly higher than that of the control (no leucaena and no fertilizer) (table 3). The two fertilizer treatments (200 and 400 kg/ha) plus leucaena pruning performed better than the Leucaena pruning treatment. The groundnut yield from Leucaena treatment did not differ significantly from that of the control. Groundnut yields from both fertilizer treatment were better than that of the leucaena pruning and the control. It is recommended that more information, particulary on the labour aspect, should be gathered on alley cropping's potential of increasing the farmers' productivity before extending it to them.

Table 1 : EFFECT OF SPACING ON THE YIELDS OF MAIZE AND GROUNDNUT IN MAIZE/GROUNDNUT/CASSAVA INTERCROP

	MEAN FRESH EAR WT. (KG/HA)			UNSHELLED GROUNDNUT WT. (KG/HA)		
	TZB	LOCAL	MEAN	TZB	LOCAL	MEAN
FARM 1						
MAIZE-2m APART	2600	5050	3825	950	900	925
MAIZE-3m APART	3950	5250	4600	1600	1450	1525
MEAN	3275	5150		1275	1175	
LSD 0.1		1648	LSD0.05			467
FARM 2						
MAIZE-2m APART	1450	3500	2475	850	1650	1250
MAIZE-3m APART	3000	2400	2700	1650	1050	1350
MEAN	2225	2950		1250	1350	
LSD 0.05		572				

Table 2 : EFFECT OF SPACING ON THE YIELDS OF MAIZE AND GROUNDNUT IN MAIZE/GROUNDNUT INTERCROP.

	MEAN FRESH EAR WT. (KG/HA)			UNSHELLED GROUNDNUT WT. (KG/HA)		
	TZB	LOCAL	MEAN	TZB	LOCAL	MEAN
MAIZE-2m APART	6267	4933	5600	567	633	600
MAIZE-3m APART	5233	3833	4533	867	800	834
MEAN	5750	4383		717	717	
LSD 0.05		1307				

Table 3 : EFFECT OF ALLEY CROPPING ON THE YIELDS OF MAIZE AND GROUNDNUTS

Treatment	Maize Grain Yield (T/ha) wt 15% moisture	Ear WT (gm)	Unshelled Groundnut wt (kg/ha)
0l + 0f	2.80	226	987
L	4.03	239	1094
200 kg/ha (20-10-10)	4.93	275	1227
L + 400 kg/ha (20-10-10)	5.37	296	1360
LSD (0.05)	0.25	31.3	125

L = Leucaena prunings;
OL = no Leucaena prunings; OF = no fertilizer

LIST OF EXTENSION AGENTS MBAM DIVISION

1 -	AMBA AMBA Gabriel	-AT-	Chief Poste Agr. Yambeta
2 -	OBA'A OBA'A Charles	-TA-	DDA Bafia
3 -	Mlle KAMANA Veronique	MONITRICE	DDA Bafia
4 -	MOUDONG ABELECK Gabriel	-ATAA-	Chief P. Bokito
5 -	MOULIOM Simeon	-TA-	Chief P. Essende (Ombessa)
6 -	OVOGUEP Elie	-TA-	Chief P. Yebekolo
7 -	FOMENE KENNE Maurice	-TA-	Chief P. Ntui
8 -	MOUKO Daniel	MONITEUR	Ntui
9 -	ABONDANA Martin	MONITEUR	PA GOURA (Ntui)
10 -	Mlle DOTHE EDITHE Honorine	Aide-Sociale	Ndiki
11 -	BIDIAS Andre	-ATAA-	Chief P. MOUTOUKOU (Ndiki)
12 -	TOUGUERI Isiako	MONITEUR	DDA Yoko
13 -	GOUFAN A. Luc	-ATAA-	Chief P. Mankim Yoko
14 -	Mlle MANGA NDONGO Francoise	-AS-	Sect. du D.C. Bafia
15 -	Mlle ADIBONI NTSAGO Brigitte	MONITRICE	DDA Bafia
16 -	MAFFISSO NGOUTE Moise	MONITEUR	DDA Bafia
17 -	MEKANG AMANG Louis	MONITEUR	DD Deuk
18 -	NGAWANA Isaac	MONITEUR	DD Deuk

LIST OF NCRE RESEARCHERS AS OF DECEMBER 31, 1986

I. International Staff

	N A M E	NATIONALITY	POSITION	LOCATION
1.	Dr. Emmanuel A. Atayi	Togolese	Chief of Party	Nkolbisson
2.	Mr. Scott Welch	American	Administrative Officer	Nkolbisson
3.	Dr. Laures Empig	Filipino	Maize Breeder	Nkolbisson
4.	Dr. Joseph Kikafunda	Ugandan	Maize Agronomist	Bambui
5.	Dr. Leslie Everett	American	Maize Breeder	Bambui
6.	Mr. Dermot McHugh	American	Agricultural Economist	Bambui
7.	Dr. D. Janakiram	Sri-Lankan	Rice Breeder	Dschang
8.	Dr. Animesh Roy	Bangladeshi	Rice Breeder	Dschang
9.	Dr. Om P. Dangi	Indian	Sorghum Breeder	Maroua
10.	Dr. H. Talleyrand	American	Cereals Agronomist	Garoua
11.	Dr. Susan Almy	American	Socio-Economist	Ekona
12.	Dr. John A. Poku	Ghanaian	Extension Agronomist	Nkolbisson
13.	Dr. Meka E. Rao	Indian	Sorghum Agronomist	Maroua

II. National Counterparts

a) In Country

NAME	POSITION	LOCATION
1. Dr. Jacob A. Ayuk-Takem	Maize Breeder NCRE National Coordinator	Nkolbisson
2. Dr. Charles The	Maize Breeder	Nkolbisson
3. Dr. Jean Tonye	Extension Agronomist	Nkolbisson
4. Mrs. Regine Aroga	Entomologist	Nkolbisson
5. Mrs. Christine Poubom	Extension Agronomist	Ekona
6. Mr. Manfred Besong	Agricultural Economist	Ekona
7. Mr. Ngoko	Plant Pathologist	Bambui
8. Mr. Fabien Jeutong	Rice Breeder	Dschang
9. Mr. Edward Ngong-Nassah	Extension Agronomist	Bambui
10. Mr. Cletus Asanga	Entomologist	Dschang
11. Mr. Andre Djonnewa	Sorghum Breeder	Maroua
12. Mr. Mbeng Ebete	Cereals Agronomist	Garoua
13. Mr. Martin Ngueguim	Extension Agronomist	Bambui
14. Mr. Celicard Zonkeng	Maize Breeder	Nkolbisson
15. Mr. Julius Takow	Rice Agronomist	Dschang
16. Mr. Ndioro a Mbassa	Maize Breeder	Bambui
17. Mr. Mongmong Blaise	Maize Breeder	Garoua
18. Mr. Mboussi A. Messia	Extension Agronomist	Ekona
19. Mr. Joseph Fokou	Rice Agronomist	Dschang
20. Mr. Nankam Claude	Cereals Pathologist	Bambui
21. Mr. Jean Bosco Zangue	Maize Breeder	Nkolbisson
22. Mr. Ndikawa Ranava	Sorghum Agronomist	Maroua
23. Mr. Dimithe Georges	Agricultural Economist	Nkolbisson

a) In Country (cont.)

	NAME	POSITION	LOCATION
24.	Miss Pauline Zekeng	Extension Agronomist	Bambui
25.	Mr. Jacob T. Eta-Ndu	Maize Breeder	Bambui

b) In Training

	NAME	SPECIALIZATION	UNIVERSITY
1.	Mr. Marc Samatana	Agricultural Economics	Michigan State
2.	Mr. Titus N. Ngoumou	Cereals Agronomy	Arkansas
3.	Mr. Francois Meppe	Extension Agronomy	Oklahoma State
4.	Mr. Richard Kenga	Sorghum Breeding	Texas A & M
5.	Mr. Ndjeunga Jupiter	Socio Economics	Univ. of Illinois