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SAFGRAD/CAMEROON FSR PROGRAMME
ANNUAL REPORT - 1986 (DRAFT)

SAFGRAD
SEMI-ARID FOOD GRAIN RESEARCH AND DEVELOPMENT

STRC/SAFGRAD/FSR/CAMEROON

P E R S O N N E L

Principal Staff

Dr. D.S. Ngambeki	FSR/SAFGRAD	Agricultural Economist and Team Leader
Dr. L. Singh	FSR/SAGRAD	Soil Scientist/Agronomist
Mr. Z.B. Boli	IRA/Maroua	Pedologist and Chief of Centre
Vacant:	IRA	Counterpart
Vacant:	IRA	Counterpart

COLLABORATORS

SODECOTON Staff		Agronomists and/or Extensionists
Mr. B. Seiny	IRA/CNS	Pedologist
Dr. Schilling	USAID/Legum	Groundnut breeder
Mr. Eyog	IRA/CRF	Forester
Dr. O.P. Dangi	NCRE	Sorghum Breeder
Mr. J; Johnson	NCRE	Agronomist
Dr. TA'Ama	USAID/Legum	Entomologist
Dr. H. Talleyrand	NCRE	Agronomist

SUPPORT STAFF

Mr. M. Kolontchang	IRA/Maroua	Accountnat (Part-Time)
Mr. S. Biassi	FSR/SAFGRAD	Aide-Accountant
Mrs. Mondjii Patience	FSR/SAFGRAD	Secretary (Part-Time)
Miss R. Nlombo	IRA	Typist
Vacant: (2)	IRA	Field Technicians
Vacant	FSR/SAFGRAD	Laboratory Technician
Mr. A.A. Fobizshi	"	Research Assistant
Vacant	"	Observator/Pitoa
Mr. R. Babale	"	" /Boula-Ibib
Pouargounal Judes	"	" /Poli
Tige Vandi	"	" /Tchollire
Mr. Wayanne Jean Claude	"	" /Bibemi
Mr. Dobio	"	" /Garoua
Mr. D. Dabai	"	" /Hama Koussou
Mr. Habra Tapsala	"	" /Ngong
Mr. D. Oumaroua	"	Driver
Mr. D. Iyawa	"	Driver
Mr. B. Mohamadou	"	Watchman
Mr. S. Tavanawa	"	"
Vacant	"	Messenger
Vacant	"	Laboratory attendant

INTRODUCTION

Farming Systems Research can be viewed as an integrated or system oriented effort designed to apply the basic results of station agricultural research to the physical, biological and socioeconomic constraints as well as the needs and environmental conditions affecting the farm as a whole and the farm family. But due to the complexity of the problems in the semi-arid regions of Africa, an appropriate FSR approach needs to integrate animals, crops and in combination with certain tree species all of which are the essential components of the system. With respect to cropping systems, the most limiting factors in the semi-arid zones are soil moisture besides fast decling soil fertility and problems of erosion. Nicou and Charreau (1985) have suggested that tillage and water conservation techniques may be efficient in terms of rain water collection by increasing infiltration rates but are not as efficient as the use of water stored by plants. However, the most important determinants for crop production by small scale farmers under Sahelian conditions are soil texture and soil fertility, total rainfall and rainfall distribution, vegetation, farmers' farming practices and farm resources available to farmers.

Farming systems Research therefore aims at improving the productivity and efficiency of a specific farming system. A FSR team can develop on FSR Programme focusing on a single subsystem or interactions with other subsystems and base their research priorities on the rural needs and major production constraints of small scale farmers in the given region or country. The Cameroon Government recognising that there is lack of agricultural research impact to maintain the rate of food production at minimum levels has various types of FSR Projects (including SAFGRAD/FSR) in the country with emphasis on on-farm testing and quick transfer of technologies to farmers in the rural areas;

ACKNOWLEDGEMENTS.

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We would also like to record with thanks the cooperation of the participating farmers. Thanks to Research Assistants and field observators for their hard work in field activities , collecting and recording of data plus data compilation.

We would like to register our thanks to SAFGRAD Coordination Office and to the STRC Lagos for their logistical support to SAFGRAD/Cameroon Programme.

Finally, our thanks go to International Fund for Agriculture Development (IFAD) for their generous financial support.

Overall Objectives of SAFGRAD/FSR

After the signing of an agreement between OAU/STRC and Cameroon Government, November 1985, the activities of SAFGRAD/IFAD funded Farming Systems Research Programme started in North Cameroon by March 1986 with the following main objectives:

(1) To develop agricultural production technologies adapted to conditions and needs of small scale farmers, with emphasis on developing soil-water, soil-moisture, soil-fertility and other resource conservation techniques in the semi-arid zone of North Cameroon.

(2) To strengthen National Farming Systems programme by working together with National researchers and extension agents while the project is jointly administrated by both SAFGRAD and the host Institution I.R.A.

(3) To foster the transfer of agricultural research results by conducting on-farm trials, socioeconomic studies etc... in collaboration with farmers and providing a feedback between station researchers, development agents and farmers.

Specific Short Term Objectives

In order to achieve these overall objectives 1986 FSR activities pursued specific objectives set up to be accomplished in defined periods of time. Thus:

(a) To conduct socioeconomic baseline surveys for obtaining some basic information on the existing crop animal production and identifying location - specific physical, economic and social constraints to agricultural production.

(b) To test the performance of sorghum, maize, groundnut and cowpea improved varieties and assess their suitability into the farming systems in Northern Cameroon.

c) To find out ways and means of minimising soil and water losses through surface run-off, and enhancing soil moisture in different types of soils existing in Northern Cameroon. That is examining the use of flat ploughing, bunding, ridging and tied ridging techniques.

) To study the effect on crop yields of animal manure vis a vis chemical fertilizer.

Institutional setting and Linkages.

All scientific Research in Cameroon, is under the Ministry of Higher Education and Scienfic Research and research is organised into six institutes such as Institute of Agricultural Research, I.R.A. Institute of Animal Research, I.R.Z., Institute of Human Sciences, I.H.S., Institute of Geological and Mineral Research, I.R.G.M., and so on, each with centres scatered all over the country.

Within the institute of Agricultural Research (IRA) there are three regional centres namely Maroua for the Northern region, Njombe for the Western region and Ekona for the Eastern region. Then plus three professional centres based at Nkolbisson for Agronomic, Forestry and Soils Research respectively. These have all together 16 research stations plus over 30 antennas. Then there are 22 research programmes one of which is the Farming Systems Programme. Each of the 22 research programmes for example cereal crops, tuber crops, Farming Systems etc... is treated as a seperate department or section within IRA as a whole and at any of the IRA centres or stations.

However, Farming Systems Programme is one of the youngest in IRA which started around 1979 with the creation of Testing and Liason Units (TLUs) in North West, West and Central provinces and more recently in Extreme North Province being carried out under the IITA-USAID supported research project.

The emphasis of FSR in Cameroon Under the TLU concept, is that of testing and transfer of cereals/based technologies .. with a bias to crop production related activities. Each TLU team consists of agricultural economist or sociologist and extension agronomist. The team operates as a unit in the field, linking up with maize and sorghum breeders and being back-stopped by station agronomists. In order to facilitate the FSR activity, Cameroon is divided into three regions (i) sudano-sahelian in the North (ii) Highlands in the west and (iii) the lowland rainfall forest in the Central and South East. There are three regional coordinators , each one based in his respective region and one overall national coordinator based at IRA head office, Yaounde.

The SAFGRAD IFAD supported Farming Systems Research programme in Cameroon, is institutionalized within the framework of IRA and is based at Garoua an antenna of the Northern regional IRA centre Maroua. The institutional setting of SAFGRAD/ FSR has the following main features.

First, it is regarded as part of the national Farming Systems Programme both by SAFGRAD and the Cameroon host Institution. Thus the contents of the research programme are developed and approved through the established national procedures. In addition, the management and logistics of the project are jointly administered by SAFGRAD and the host institutions.

Secondly, although SAFGRAD/FSR at the moment operates as a project, there are some plans to improve it to a level which could be close to a department at IRA Garoua and possibly serving the whole of Northern region.

Thirdly the SAFGRAD/FSR/Cameroon is being developed to cover a wider scope including crop production with respect to cropping patterns and soil fertility management, livestock production and planting of tree species with emphasize on

the interrelationship and interactions of these subsystems under the prevailing socioeconomic environment and give the farmers resources.

Finally, the SAFGRAD/FSR, in North Cameroon has important linkages. For example, besides collaborating and being backstopped by other IRA scientists working at research stations especially on maize,sorghum, cowpeas and groundnuts, the SAFGRAD/FSR team also collaborates with the Institute of Animal Research IRZ on the use of animal traction and the integration of crop with livestock production systems. For the on-farm farmer-managed, the FSR team cooperates with SODECOTON a parastatal responsible for the production of cotton and a rural development agency in the Northern region. Other collaborators are the extension personnel from the ministry of Agriculture, the Project of North East Benoue, the seed Multiplication Project nad Karewa Experimental Farm.
At the internation level SAFGRAD/FSR/Cameroon cooperates with SAFGRAD Projects in other countriesplus IITA, ICRISAT and FAO in various ways.

As regards research support facilities, IRA has allocated SAFGRAD/FSR some office space sharing a four bedroom rented house at Garoua with Cereals section (Maize, and sorghum agronomy) uplandrice section and fruits section. IRA has also provided SAFGRAD/FSR with a typist at Garoua and a part-time accountant at Maroua.

Traditionally IRA has a policy to supply a counterpart and one to two agricultural technicians foe every expatriate Scientist. However in a few cases including SAFGRAD, the appointment of counterparts have been delayed due to lack of suitable young graduates and/or shortage of funds. With respect to training, this is still pending the appointment of counterparts and agricultural techincians.

DESCRIPTION OF THE PROJECT AREA

The SAFGRAD Project area covers North Province and Southern part of Extreme North Province. The North Province lies in a large depression of the Benoue river basin consisting of the lower Benoue valley on the west with an altitude of less than 1000m and the intermediate Benoue valley in the north east with an altitude of 1000m to 2000m above sea level. The area then extends into the Mandara highlands on the north west side and Diamare plans on the north east side and boardered by Adamaoua highlands on the southern side. The North Province lies between longtitude 12° 30' E and 15° E and latitude 7° N and 10° N.

Temperatures

Considering the variations in temperatures for the region stretching from Ngaoundere in Adamaoua Province in the South to N'Djamena in Tchad on the far Northern side, Garoua has the hottest climate, followed by N'Djamena, then Maroua and finally Ngaoundere. The temperatures around Garoua where the SAFGRAD/ FSR Project is based, range from a minimum of 17°C in January to a maximum of 45°C in March. Whereas the temperatures in N'Djamena range from a minimum of 13.9°C in January to 41.2°C in March. The temperatures in Maroua range from 16.9°C in January to 41°C in March while those in Ngaoundere range from 11°C in January to 33.2° in March.

At Garoua the climatic conditions are hot and humid. The average annual temperature is 28°C with monthly averages ranging between 26.5°C in January to about 34°C in March. The hottest months at Garoua are March, April and May. The average temperature at Maroua is 27°C with monthly average ranging between 25°C in January to 32°C in March and the hottest months are March, April and May. At Ngaoundere, the average temperature is 22°C with monthly averages ranging between 21°C in January and 25°c in March . The temperatures even during the hottest month of March, are moderate.

Rainfall

North Cameroon has a tropical climate. Annual rainfall decreases from south to north, and there is pronounced by long dry season and most soils are dry for at least three months.

The range in annual rainfall in North Cameroon is moderately wide reflecting a sensitive balance in the dominating pressure systems. Long term (20 years) data

from recording sites indicate that monthly rainfall increases from April to July-August, Table(1a) SAFGRAD-FSR recorded the rainfall data during the crop season of 1986 from several locations wherever agronomic trials were laid outon farmers fields The rainfall data has been summarised sector wise from three different regions of North Province of Cameroon. Rainfall data has been given at 10 days intervals for each Month and also the total number of rainy days. See Table 1b, 1c and 1d.

In general, the season was quite normal as far as the rainfall is concerned. However, a closer look at the data reveals that in the Bibemi sector of north east Benoue, Table (1b) shows that there was quite low rainfall between 21st June and 20th July, 1986 (Fig 1). This caused delay in planting short duration sorghum and also poor yield of already planted long season sorghum and maize (planted in first week of June, 1986). It is worth to mention here that one of the SAFGRAD sorghum trial failed due to this dry spell and also the maize variety trial gave low yield. Some of the other sectors namely Baikwa, Guider in the Extreme North Province, Poli in west Benoue of North Province experienced quite low rainfall between 11th June and 30th June. Thus (20 days) and this is the "time" when most of the farmers plant their cereals. This type of erratic rainfall caused delayed planting and risk of failure or poor yield of crops if rain cuts off early towards the end of rainy season. However total rainfall in the year 1986 was turned out to be quite favourable due to effective rainfall upto the middle of October. (Table 1b and 1c).

Rainfall in the south east Benoue area of North Province of Cameroon receives quite high rainfall as compared to north east Benoue and west Benoue areas. (See Table 1d). In general south east Benoue area of North Province of Cameroon has not much problems of moisture stress due to adequate rainfall rather some of the areas faced runoff and soil erosion problem through heavy downpours.

Table 1a

20 YEARS AVERAGE RAINFALL PATTERN BY REGIONS OF NORTH PROVINCE OF CAMEROON, 1986

Region	Jan.	Feb.	Mar.	April	May	June	July	August	Sept.	Oct.	Nov.	Dec.	Total
North Benoue	-	-	-	29.4	82.2	105.5	202.1	232.8	160.8	51.6	11.8	-	876.3
West Benoue	-	0.03	2.1	45.5	102.4	116.5	185	249.5	170.9	52.7	1.3	-	926.9
South Benoue	-	0.24	7.78	57.8	127.2	152.1	246.8	286.3	224.7	90.6	2.9	-	1196.4

Table 1b

NORTH EAST BENOUE

Mean Rainfall (mm) (10 days interval) for North Cameroon, 1986.

Sector	Decade	March	April	May	June	July	August	Sept.	Oct.	Nov.	Grand Total	Total No. of rainy days
Pitoa	1	-	1.0	42.3	39.6	74.8	45.2	95.0	25.7	-		
	2	-	-	26.5	37.3	61.9	58.9	80.2	17.5	-		
	3	-	2.0	13.5	40.0	125.3	98.0	48.1	3.5	-		
	T	-	3.0	82.3	116.9	262.0	202.1	223.3	46.7	-	936.1	55
Bibemi	1	-	-	14.1	72.0	15.7	73.0	78.5	27.8	-		
	2	-	5.0	20.4	58.3	16.3	70.5	38.4	4.7	-		
	3	-	6.5	19.0	17.0	82.3	50.7	47.2	-	-		
	T		11.5	53.5	147.3	114.3	194.2	164.1	32.5	-	717.4	48
Paderma	1	-	-	-	27.0	73.0	39.8	20.3	64.8	-		
	2	-	-	21.6	43.0	40.7	96.4	56.3	-	-		
	3	-	-	54.2	75.0	107.3	58.5	30.8	19.9	-		
	T			75.8	145.0	221.0	194.7	106.4	84.7		827.6	48
Baikwa	1	-	-	8.0	40.3	55.5	63.3	81.8	46.0	8.5		
	2	-	-	46.1	19.1	13.9	93.3	35.3	23.5	-		
	3	-	24.1	65.1	22.8	31.8	120.0	37.6	8.0	-		
	T		24.1	119.2	82.2	101.2	276.6	154.7	77.5	8.5	844.0	57
Overall monthly mean		-	9.7	82.7	122.9	174.6	216.9	162.1	60.4	2.1	831.4	52

...8b...

Table 1c:

WEST BENOUE

Mean Rainfall (mm) (10 days interval) for North Cameroon, 1986.

Sector	Decade	March	April	May	June	July	August	Sept.	Oct.	Nov.	Grand total	Total N° of rainy days.
Hama Koussou	1	-	-	22.1	55.6	83.0	85.3	46.6	10.6	0.5		
	2	-	-	17.0	48.8	43.8	86.6	18.0	11.3	-		
	3	-	6.0	98.0	94.1	139.6	50.0	24.5	9.0	-		
	T		6.0	48.9	198.5	226.4	221.7	89.1	30.9	0.5	862.0	42
Guider	1	-	-	-	48.9	43.0	47.0	63.0	36.0	-		
	2	-	-	5.0	21.0	37.0	12.0	92.0	-	-		
	3	-	-	20.0	12.0	153.0	125.0	57.0	18.0	-		
	T	-	-	25.0	81.0	233.0	184.0	212.0	54.0	-	789.0	52
Poli	1	-	4.0	3.5	72.0	65.6	75.3	100.3	35.6	-		
	2		-	18.0	16.8	52.3	96.8	83.8	43.8	-		
	3	-	9.0	31.0	10.5	90.0	43.5	46.1	65.5	-		
	T		13.0	52.5	98.3	207.9	215.6	240.2	143.9		971.4	51
Djalingo	1	-	3.5	10.0	84.0	37.0	59.4	60.0	8.0	-		
	2	-	-	11.5	86.0	74.0	53.0	46.0	7.0	-		
	3	-	5.0	28.0	70.3	133.0	56.0	35.0	-	-		
	T	-	8.5	49.5	240.3	243.9	168.4	141.0	15.0	-	866.6	62
	1	-	-	6.3	40.5	15.0	46.0	88.5	14.7	-		
	2	-	-	30.4	76.3	22.0	34.6	60.0	24.5	-		
	3	9.0	4.2	21.5	13.7	79.3	36.0	69.5	13.2	-		
	T	9.0	4.2	58.2	130.5	116.3	116.6	218.0	52.4	-	705.2	47
Overall monthly mean		1.8	6.3	46.8	149.7	213.5	181.3	180.1	59.2	0.1	838.8	51

Table 1d:

South East Benoue

Mean Rainfall (10 days interval) for North Cameroon, 1986.

Sector	decade	March	April	May	June	July	August	Sept.	Oct.	Nov.	Grand Total	Total Nº of rainy days
Madingrin	1	-	-	7.1	45.4	48.3	110.3	37.1	66.0	-		
	2	-	0.5	5.2	31.4	65.2	47.2	72.0	22.0	-		
	3	-	-	5.5	72.2	71.4	164.6	86.0	45.5	-		
	T	-	0.5	17.8	149.0	184.9	332.1	195.1	133.5	-	1002.9	51
N'dock	1	-	4.8	8.6	27.8	70.2	92.4	88.6	12.1	-		
	2	1.6	1.4	26.0	49.0	96.0	22.0	28.4	4.5	-		
	3	13.1	12.5	39.2	15.4	94.5	82.9	87.0	12.0	-		
	T	14.7	18.7	73.8	93.0	260.7	197.3	204.0	24.6	-	890.8	59
Sorombeo	1	-	-	19.0	60.0	158.7	110.0	63.7	12.0	3.0		
	2	4.0	1.0	16.8	110.5	82.0	92.0	65.3	10.0	-		
	3	2.0	2.3	13.3	33.6	110.1	127.4	13.1	8.2	-		
	T	6.0	3.3	49.1	204.1	350.8	329.4	142.1	30.2	3.0	1118.0	52
Tchollire	1	-	0	8.6	6.4	65.1	55.0	54.0	73.3	1:0		
	2	-	12.0	9.5	100.4	63.0	41.4	42.0	8.2	2.1		
	3	-	4.0	56.5	74.3	56.3	107.0	31.4	20.0	-		
	T		16.0	74.6	181.1	184.4	203.4	127.4	101.5	3.0	891.4	47
Touboro	1	-	12.1	17.6	21.1	114.0	38.7	35.3	12.4	1.9		
	2	-	-	6.2	46.8	47.1	66.2	54.1	6.1	-		
	3	18.7	8.0	35.5	34.5	81.6	127.6	40.1	12.1	-		
	T	18.7	20.1	59.3	102.4	242.7	232.5	129.6	30.6	1.9	837.8	53
Sud Vina	1	-	-	34.5	35.0	105.5	34.5	19.2	49.5	20.0		
	2	-	-	9.5	68.0	28.5	44.0	56.0	17.5	-		
	3	11.0	21.5	33.0	74.5	62.0	112.0	39.3	33.5	-		
	T	11.0	21.5	77.0	177.5	196.0	190.5	114.5	100.5	20.0	908.5	53
Overall monthly mean:		8.4	13.4	58.6	151.3	236.7	245.9	152.2	70.3	4.6	941.5	53

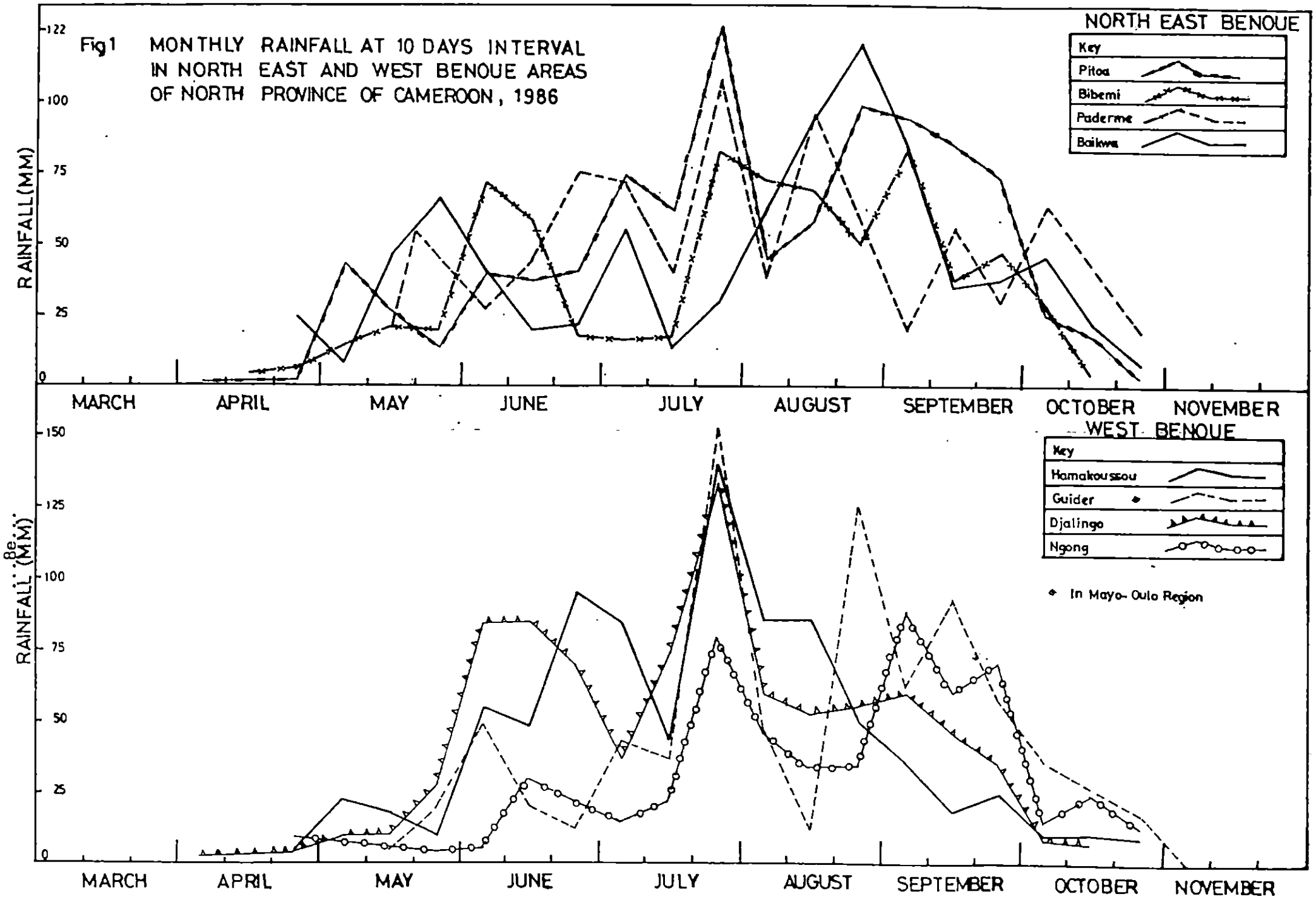
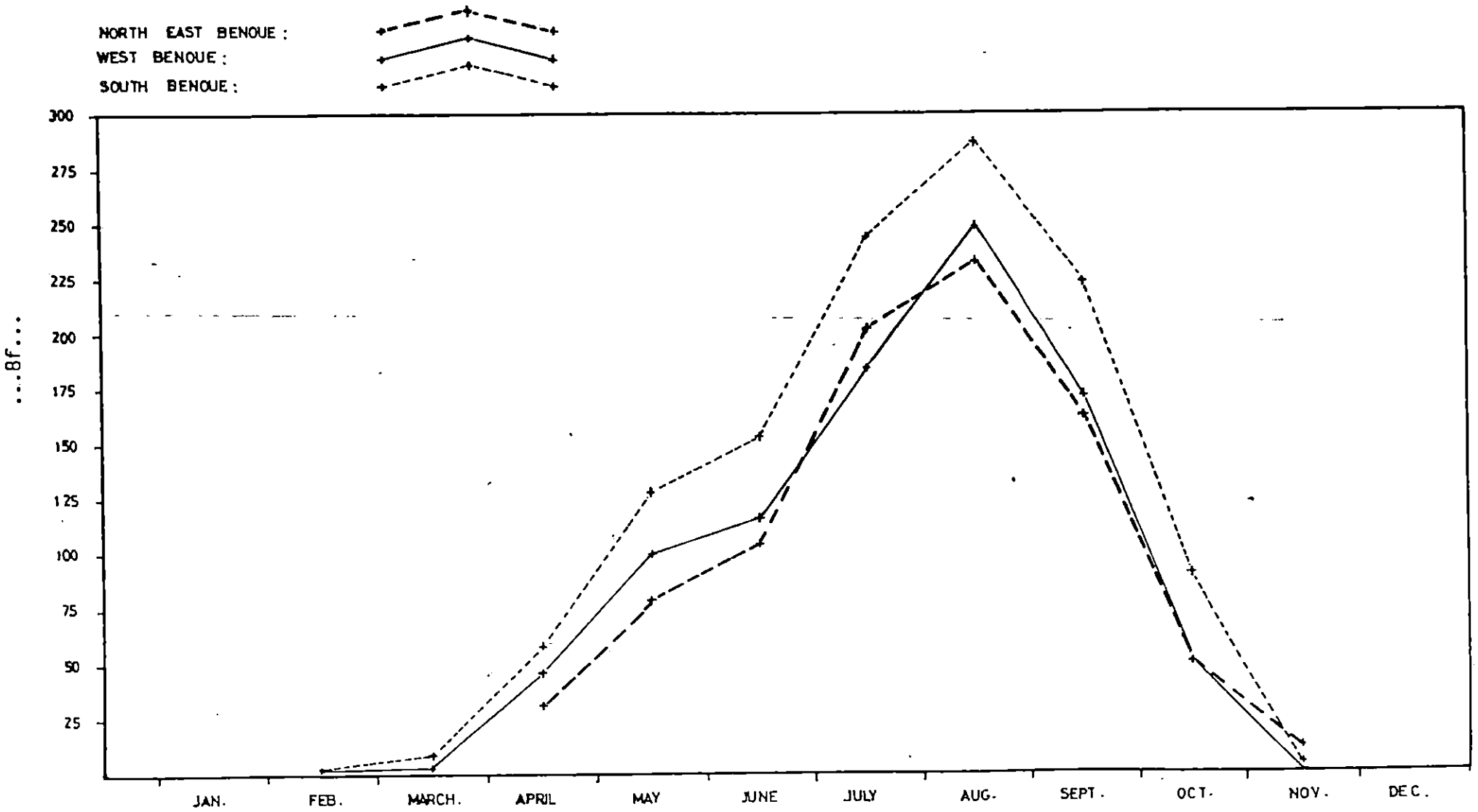


Fig 1 MONTHLY RAINFALL AT 10 DAYS INTERVAL IN NORTH EAST AND WEST BENOUE AREAS OF NORTH PROVINCE OF CAMEROON, 1986
NORTH EAST BENOUE
Key
Pitoa
Bibemi
Paderme
Baikwa
RAINFALL(MM)
0
25
50
75
100
122
MARCH
APRIL
MAY
JUNE
JULY
AUGUST
SEPTEMBER
OCTOBER
NOVEMBER
WEST BENOUE
Key
Hamakoussou
Guider *
Djalingo
Ngong
* In Mayo- Oulo Region
RAINFALL (MM)
0
25
50
75
100
125
150
MARCH
APRIL
MAY
JUNE
JULY
AUGUST
SEPTEMBER
OCTOBER
NOVEMBER

Fig.1 B 20 YEARS AVERAGE RAINFALL PATTERN BY REGIONS OF NORTH PROVINCE OF CAMEROON, 1986



major constraints of food production

From the reconnaissance trips by the SAFGRAD/FSR team and review of previous literature suggest that the major constraints of food production in North Cameroon are (a) drought and/or prolonged dry spells at the time of planting (b) poor soils and declining soil fertility and (c) uneven distribution of the population, Diamare and Margui-Wandala areas of the Extreme North Province are relatively more populated than other parts of both the North and Adamaoua Provinces. In the Extreme North Province where there are older settlements and due to population pressure on the land plus the effect of soil erosion caused by torrential rains, winds and human cultivation, soils have become extremely poor, sandy, hard pans or even just bare rocks. As a result, the upper Benoue valley Development Survey Authority has among its aims to open up new settlement in Benoue Valley and to settle in Migrants from the more populated areas of far North parts of the country. The other constraints include inavailability of inputs and/or lack of appropriate small farm tools to circumvent critical land preparation and planting periods. It was also noted that striga weeds, particularly against millets and sorghum pose a major problem. Post-harvest losses due to inadequate storage, transportation and marketing facilities create additional bottlenecks to food supplies.

Economic setting and background

(a) Population

The total population of Cameroon is about 10.68 million people (1986) with a population growth rate of 2.4% per annum. The age distribution of the population of Cameroon is such that 24.1% (2.58 million) are of age group 0-5 years, (2.55 million) 23.8% are of school age group 6 -14 years and (5.07 million) 47.5% are of working age group 15-59 years old Whereas (0.479 million) 4.5% are of age group 60 years and above. In other words the opulation structure in Cameroon is such that 47.9% are children under 15 years old, 47.5% of age group 15 -59 years and 4.5% are aged 60 years and above.

Of these, about 50.1% are female and 49.9% are male. The population density in Cameroon has an average of 21 persons per km². The population density is highest in West Province, followed by NorthWest Province then Littoral Province with respectively 95.2, 66.9, and 47.2 persons per km². Whereas the average population density in the Northern region is 16.5 persons per km². However, the three Northern Provinces together carry 27.6% of the total population followed by Central-South and West Province which carry respectively 21.1% and 13.9% of the population.

Some parts of the country suffer from uneven distribution of the population. For instance there are three zones that have relatively high density population which put together englobe 61% of the population of Cameroon and yet constitute only 13.3% of the territory. The areas with high population density are Diamare, Margui-Wandala in the Far North, Bamenda to Douala in Western and Lekie to Yaounde in the Central-South.

There is a high rate of rural-urban migration in the country. About 38% are Urban dwellers, whereas 62% are rural dwellers. Some of the large Urban Centres in Cameroon are Douala (750.000 inhabitants), Yaounde (530.000 inhabitants). As a whole there are 17 Urban Centres in the country with more than 20.000 inhabitants. However in the North and Extreme North Provinces, about 80% of the population are rural dwellers. Garoua (64,000 inhabitants) and Maroua (67,000 inhabitants).

(b) Economic Activities

The economy of Cameroon is mainly based on agricultural production and is greatly backed up by the activities of agricultural parastatols (such as SODECAO, SODECOTON, OCB, MIDEVIV, Cereals Office, SODEBLE, SODERIM, SODENKAM, UCCAO, CENADEC, ONCPB, Chamber of Agriculture, Livestock and Forestry, etc....).

So far Cameroon is one of the African countries with a positive economic growth

in the last decade. Between 1974/85 and 1979/80 the Gross Domestic Product of Cameroon increased from (579.900 million CFA to 1.356.200 million CFA with a growth rate of 18.5% per annum. Considering an economic inflation of 13%, the per capita GDP of Cameroon in real terms grew at about 2.24% per annum. (5th five - year DevelopmentPlan 1981-1986). The performance of the Cameroonian economy between 1980 and 1985 was quite favourable compared to most of the Central and West African economies. For instance the per capita Gross National Product of Cameroon between 1984-1986 averaged 800 U.S. dollars as compared to that of Nigeria, Liberia and Zaire which had respectively per capita income of 730, 470, and 140 U.S. dollars in the same period (World Development Report 1986). The Cameroonian economy exports Cocoa, Coffee, Tea, Bananas, Cotton, Rubber, Timber, Palm oil, Tobacco, Groundnuts and Petrol. While in early 1980s the Cameroon economy benefited from positive economic policies and favourable agricultural prices, during 1986, the economy has been adversely affected by falling oil prices and depressed prices of Cotton (World Bank Annual Reports 1985, 1986).

Production of food crops

The important food crops are cereals millets/sorghum, maize and rice and starchy foods crops - plantain, cassava, yams, cocoyams, palm oil and bananas. The cash crops include cotton, coca, coffee, oil seed crops, rubber, bananas and pineaple. Whereas groundnut serves a dual purpose of food and cash crop. Considering the land mass of Cameroon being about 46.5 million hectares only 6.3% is under agricultural production whereas 36.5% is under livestock, 42.1% under forest and about 14.8% under water.

By 1980, food crop production in Cameroon was in thousand tonnes, 407 millet and sorghum, 416 maize, 69 rice, 80 groundnuts, 5 sesame, 618 cassava, 415 yams, 66.9 sweet potatoes, 808 cocoyams and 24 irish potatoes.

These production levels satisfy only 60 to 90% of the domestic food demand (1981/86 five year development plan). In order to keep up with the levels of consumption and population growth rates, food production needs to increase by at least 4.6% for maize, 22% for rice, 3.6% for groundnuts and 1% for sorghum and millets. In North Province, where the SAFGRAD/FSR is based, the most important food crops are millets, sorghum, maize, rice and cowpeas, then groundnuts plus cotton which are cash crops.

The Northern region of Cameroon produces 60 to 80% of the grain Cereals in the country, yet their farm yields are low ranging from 0.5 t/ha to 1.2 t/ha. See Table 2.

Production and area under crop in Northern Cameroon 1982/83.

Table 2.

Crop	Production 1000 M.T.	Area (1000 ha)	Yield (kg/ha)
Sorghum rainy season	309	387	800
Sorghum Muskwari	55	109	900
Millet	25	47	520
Maize	78	70	1124
Rice	7	6	1245

Source: Provincial Delegation of Agriculture.

About 39% of the production of millet and sorghum is by small scale farmers under the advisory services of SODECOTON, about 9% under the advisory services of Ministry of Agriculture while 50% of the millet and sorghum production is under traditional farming. As for cotton in 1984/85 SODECOTON realised 73,316 hectares of which 67,455 were under improved methods and 5,860 were under traditional farming (SODECOTON report 1984/85).

Livestock is an important component in the region For there are about 3.43 million heads of cattle and five million sheep and goats in the country. Over sixty percent of these are in the Northern Provinces of Cameroon. But during the dry season, the cattle keepers transhumance from the extreme North and North Provinces southwards in search of grazing grounds and water.

Implementation Strategy

In order to achieve the SAFGRAD/Cameroon FSR objectives, the implementation strategy consist of first the location of activities: Thus seven primary sites each with two to three secondary sites were selected from eight sectors namely Pitoa, Hama Koussou, Boula-Ibib, Ngong, Bibemi, Figuil, Poli and Tchollire. In the primary sites, FSR activites were carried out at three levels: Thus (a) exploratory and socioeconomic baseline studies, (b) researcher-managed agronomic trials and (c) farmer-managed on-farm trials. At the secondary sites, there were two levels of activities namely socioeconomic studies and on-farm farmer-managed trials and during 1986 there were a large number of tertiary sites consisting just of on-farm farmer-managed agronomic trials.

Secondly, the sequence of the research activities are:

(a) To conduct exploratory and socioeconomic baseline studies in some selected primary and secondary sites in order to identify and obtain a detailed analysis of the constraints.

(b) To mobilize technological and natural resources available to address the identified production constraints.

(c) To conduct research managed agronomic trials at six primary sites, incorporating two to four technological components and integrating two or three levels of production or farm management levels, thus using a two or three ways statistical design.

(d) To conduct on-farm trials in collaboration with extension and/or development agents and farmers.

(e) To initiate economic evaluation of some promising technologies being tested in agronomic trials.

Thirdly, field assistants are posted to work in villages one per primary site and they reside at their place of work together with farmers. This keeps field assistants in close contact with farmers with whom they work. It also encourages mutual confidence where farmers regard field assistants as part of their community thus improving both the quality of work and the data being collected.

SAFGRAD/FSR Programme Development

The SAFGRAD/Cameroon FSR Programme is being developed to incorporate the subsystems that are significantly present in the existing local farming systems.

Thus: 1. Crop Production to cover

(a) soils including (i) soil fertility and soil conservation (ii) soil water and soil moisture and (iii) recycling soil nutrients and (b) cropping systems including (i) cropping patterns (ii) cropping systems and crop management plus (iii) crop variety testing.

2. Socioeconomic studies to cover

(a) Farm resources such as (i) land, (ii) labour and (iii) purchased farm inputs like chemical and small tools. (b) economic analysis and evaluation of technologies and (c) socioeconomic studies of infrastructural facilities like

storage, transportantion, farmers' organisations and marketing facilities including prices.

3. Livestock - covering particularly use of (i) animal traction and (ii) animal manure and their inter-relationship between the use of crop residues as sources of animal feed and the general interactions between livestock and crop production.

4. Agroforestry with particular emphasis on testing of adaptable tree species. tree-crop combination and agrosilvipastoral systems.

Results of Socioeconomic studies

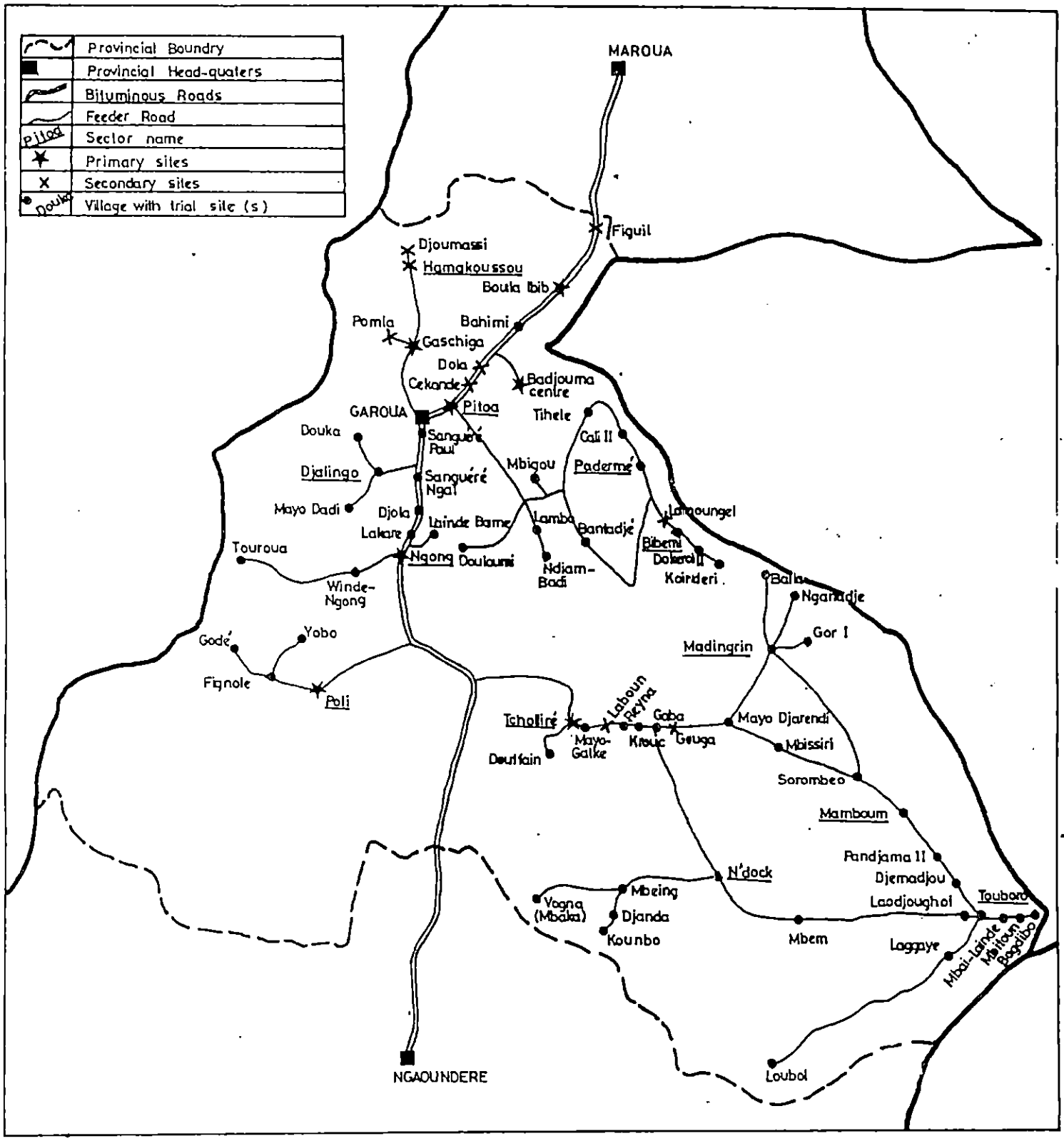
The objective of socioeconomic exploratory and baseline studies were (a) to obtain basic information on the existing crop and livestock production systems and (b) to identify location-specific physical, biological and socioeconomic constraints to agricultural production (c) to select sites and participating farmers for the on-farm adaptive trials.

Methods: Selection of sites and participating farmers

The selection of the primary sites was based on such criteria as (i) representative of major soil types (ii) accessability (iii) relative location and size of the village plus (iv) an area where there are major Government Programs positive findings can be easily supported and implemented. The selected primary sites are Pitoa, Badjouma, Boula-Ibib, Ngong, Gaschiga, Poli, Bibemi and Tchollire. These sites are spread out in North Province of Cameroon see Fig. 2 Around each primary site there are two or three villages serving as secondary sites.

Five to ten farmers per village were selected using random sampling methods and based on the size of the farming population in the village concerned. As cotton is a major cash crop activity in the region, care was taken to include cotton and non-cotton farmers (Table 3)

Fig 2 MAP OF NORTH PROVINCE SHOWING SAFGRAD SOCIO-ECONOMIC SURVEYS AND AGRONOMIC TRIAL SITES



The activities of the FSR Project include, socioeconomic studies, agronomic researcher-managed trials and on-farm farmer-managed trials,

Table 3

Distribution of selected villages and sample of farmers by sectors of North Province of Cameroon, 1986.

Region/Sector	Number of villages	Sample of Farmers		
		Cotton	Non-cotton	Total
North East Benoue				
Pitoa	5	20	9	29
North Pitoa/Guider	4	17	14	31
Bibemi	4	15	17	32
West Benoue				
Ngong	2	10	2	12
Hama Koussou	3	18	6	24
South Benoue				
Poli	4	15	15	30
Tchollire	4	20	8	28
Total	26	115	71	186

Source: Farm surveys 1986

These are concentrated mainly on primary sites, then secondary sites. There are 8 primary sites and 16 secondary sites plus some villages that are just being used only as trials sites. See Fig 2.

For the socioeconomic studies, 186 farmers were selected from a total of 26 villages Of these, 115 (62%) are cotton farmers and 71 (38%) are non-cotton farmers. See Table 3. Data colllection is by interviewing procedures of repeated visits to farmers by making observations and/or score rating by a data collection team.

For working convenience and according to the existing major rural development programs, the SAFGRAD/FSR Project area is subdivided into North East Benoue, West Benoue and South Benoue.

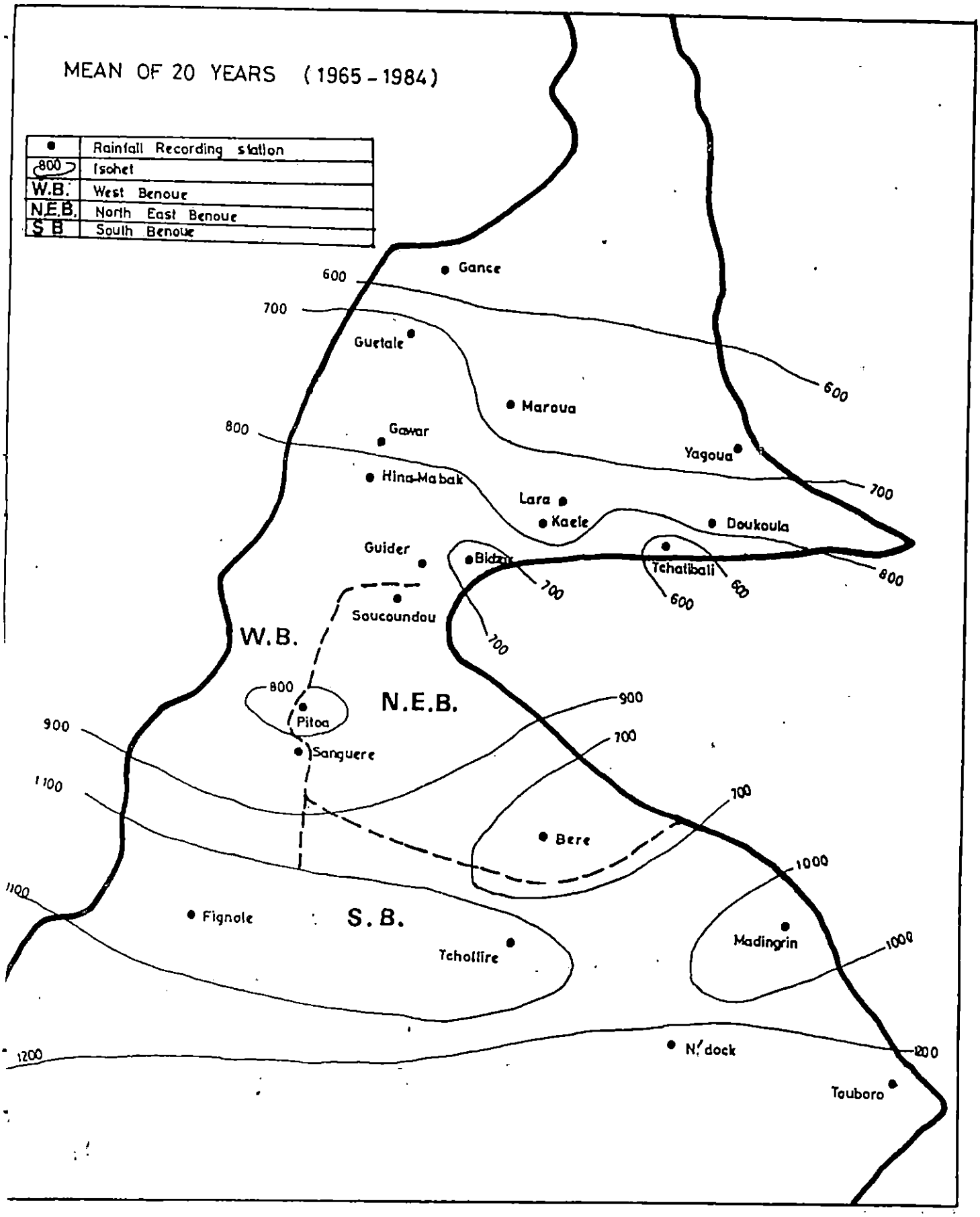
Socioeconomic Findings.

Agroclimatic

According to the rainfal pattern and vegetation, the project area can be divided into sahelian savanna zone with mean annual rainfall of 800-600 mm, sudan savanna zone with 1000-800 mm and Guinea savanna zone with 1200 - 1000 mm. The sahelian savanna zone covers the Extreme North Province and part of North Province, the typical sudan savanna zone is between Guider and Ngong whereas the Guinea savanna zone is located mainly in the south of Benoue and from around Fingole southwards to Adamaoua Province, See Fig. 3. Along the sudan savanna zone, there are pockets where annual rainfall is less than 800 mm. Considering the rainfall figures of the last twenty years, the trends of the rainfall pattern in each of the zone tend to decline by 5 - 10 percent, with high frequent occurances of serious drought during certain years. See Fig 1b.

In the Guinea savanna zone, the on set of the rains usually start in April and cuts off at the end of October. In the sudan savanna zone, rains begin end of April/ early May and cut off at the end of October. In the sahelian savanna zone, the rains begin end of May and cut off by end of October.

Fig 3 RAINFALL OF NORTH AND EXTREME NORTH PROVINCE



These agroclimatic zones correspond to agricultural regions of north east, west and south Benoue regions respectively and all the regions have their peaks in August... See Fig 3b.

Demographic Characteristics of Farmers

Table 4 shows the demographic characteristics of farmers in the three region of North Province. The average size of the farm family in the province is 9 to 10 persons of whom 53% are children between 0 and 16 years old, while 47% are persons above 16 years old. The male population is about 48% while the female population is about 51.2%. The farmers can supply an average of 5.46 man-units per farm family. The age distribution of families are such that about 29.5% are of age group 0 - 8 years, 23.9% of age 9 - 16 years, 35.3% of age of age group 17 - 42 years, 8% of age group 43 - 59 years and 3.3% of age groups 60 years. According to Table 4, there are more farm families in west Benoue that are larger and have more children of age group 0 - 8 years but less persons of age group 17 - 42 years than those in the other two regions.

Existing Farming Systems

The existing farming systems of North Cameroon has two main components namely crop and livestock production systems. Sorghum, Millets, and Cowpeas are the principal traditional food crops. Cotton is a dominant cash crop while groundnuts serve both as a cash crop and a food crop. The production of cotton is strongly being supported by SODECOTON which besides supplying technical advisory services it gives credit inputs such as fertilizers, ox-plough, tractor hire, spraying equipments and chemicals and provides free cotton seeds. SODECOTON also organises the buying, transportation and storage of cotton at harvest.

Table 5 shows crop enterprices grown by farmers in regions of North Cameroon. According to Table 5, cotton is normally planted in pure stand and grown by 62% of the farmers in North Province.

TABLE 4 DEMOGRAPHIC CHARACTERISTICS OF SELECTED FARMERS PER FAMILY

AND BY REGION OF THE NORTH PROVINCE OF CAMEROON, 1986

REGION	Family size	Number of males	Number of Females	Number of Children 0-16 years	Number of persons 17-60+ years	Labour available man-units	AVERAGE NUMBER OF PERSONS PER FAMILY BY AGE GROUP	0 - 8	9 - 16	17 - 42	43 - 59	60+
North East Benoue	9.43	4.39	5.04	4.97	4.45	4.88	M	1.29	1.15	1.35	0.44	0.19
							F	1.5	1.14	2.06	0.34	0.05
		46.5%	53.5%	52%	48%		T	2.79	2.29	3.41	0.78	0.24
								29.3%	24.1%	35.8%	8.2%	2.5%
West Benoue	12.16	6.19	5.97	6.91	5.24	6.85	M	1.91	1.83	1.69	0.46	0.27
							F	2.05	1.05	2.05	0.41	0.27
		50.9%	49.1%	56.8%	43.2%		T	3.96	2.88	3.74	0.87	0.54
								33%	24%	31.2%	7.2%	4.5%
South Benoue	7.34	3.79	3.55	3.71	3.61	4.40	M	1.01	0.89	1.36	0.36	0.15
							F	0.93	0.75	1.39	0.25	0.13
		51.6%	48.4%	50.5%	49.5%		T	1.94	1.64	2.75	0.51	0.28
								27.2%	23%	38.6%	7.2%	2.9%
	9.31	4.55	4.76	4.96	4.35	5.46	M	1.30	1.2	1.42	0.41	0.19
							F	1.43	1.01	1.85	0.33	0.12
		(48.8%)	(51.2%)	(53%)	(47%)		T	2.73	2.21	3.27	0.74	0.31
								(29.5%)	(23.9%)	(35.3)	(8%)	(3.3%)

M= Masculine, F= Feminine, T= Total.

Source : Farm Surveys, 1986

TABLE 5 CROP ENTERPRISES GROWN BY FARMERS IN REGIONS OF NORTH PROVINCE OF CAMEROON, 1986

Crop enterprise	PERCENTAGE OF FARMERS			
Grown	NORTH EAST BENOUE	WEST BENOUE	SOUTH BENOUE	NORTH PROVINCE
Cotton	52	77	52	62
Maize	72	77	75	75
Red sorghum	91	86	43	75
Groundnuts	96	83	84	85
Cowpeas	53	72	21	48
Muskwari	24	67	20	42
Sorghum/Cowpea in association	11	42	17	19
Sorghum/Groundnuts in association	9	30	17	16
Maize/Millets	3	19	10	9
Groundnuts/Cowpeas	12	-	3	7
Maize/Cowpea	3	-	-	-
Maize/Groundnuts	3	-	-	-

Source: Farm Surveys, 1986

Whereas maize, red sorghum, groundnuts and cowpeas are being grown in pure stand by respectively 75, 75, 85 and 48% of the farmers. Groundnuts is the most popular crop grown in pure stand by 96% of the farmers in North East Benoue, plus 83 and 84% of the farmers in west and south Benoue respectively. The other popular crop enterprises in all the regions of Northern Province are red sorghum, maize and cotton. Cowpeas grown as pure crop, is mostly found in west and north east Benoue regions, but less popular in south Benoue. Muskwari, which is grown on residue moisture during the dry season, is grown by more farmers in west and north east Benoue than in south Benoue The most common crop associations on farmers fields in North Province are sorghum/cowpeas grown by 19% of the farmers, sorghum/groundnuts by 16% of the farmers, maize/millet by 9% and groundnuts/cowpeas by 7% of the farmers. Other crop association include maize/cowpeas and maize/groundnuts.

The average farm size per farm family in the region is 1.74ha ranging from 0.25ha to 12 ha. The scale of agricultural production is such that 70% of the farmers have farm sizes 0.25ha to 2 ha, 20% of farmers have 2 to 4ha, 5% of farmers 4 to 6ha, 2% of the farmers have 6 to 8 ha and 2% have 8 to 12ha. The small scale farmers usually partition their farms in terms of 0.25ha per piece and allocate one or two parcel/to one crop enterprise .

Cropping Systems:

The cropping systems in North Province is such that farmers plant cotton followed by sorghum - sorghum in a rotation or cotton followed by sorghum then cotton/maize, or cotton/groundnuts in a rotation. A cropping pattern of cotton/maize or cotton/groundnuts is also commonly used byfarmers in a rotation. The cropping patterns for non-cotton farmers are sorghum/groundnuts followed by maize/sorghum, maize/groundnuts or cowpeas/maize. Most non-cotton farmers use a simple rotation of maize followed by sorghum, maize followed by groundnuts or sorghum followed by groundnuts in a rotation.

Cropping Calendar

The length of agricultural season in North Province is short varying from four months in the northern parts to six months in the south. The date of planting is therefore the most critial period to farmers in the region. In south Benoue where the rainfall is over 1100 mm, starting from April, cutting off end of October planting is normallydone from May to Mid-June. But both north east and west Benoue regions have shorter agricultural season with rainfall between 800 - 900 mm. The planting period in these regions is quite short, starting from Mid-May to Mid -June.

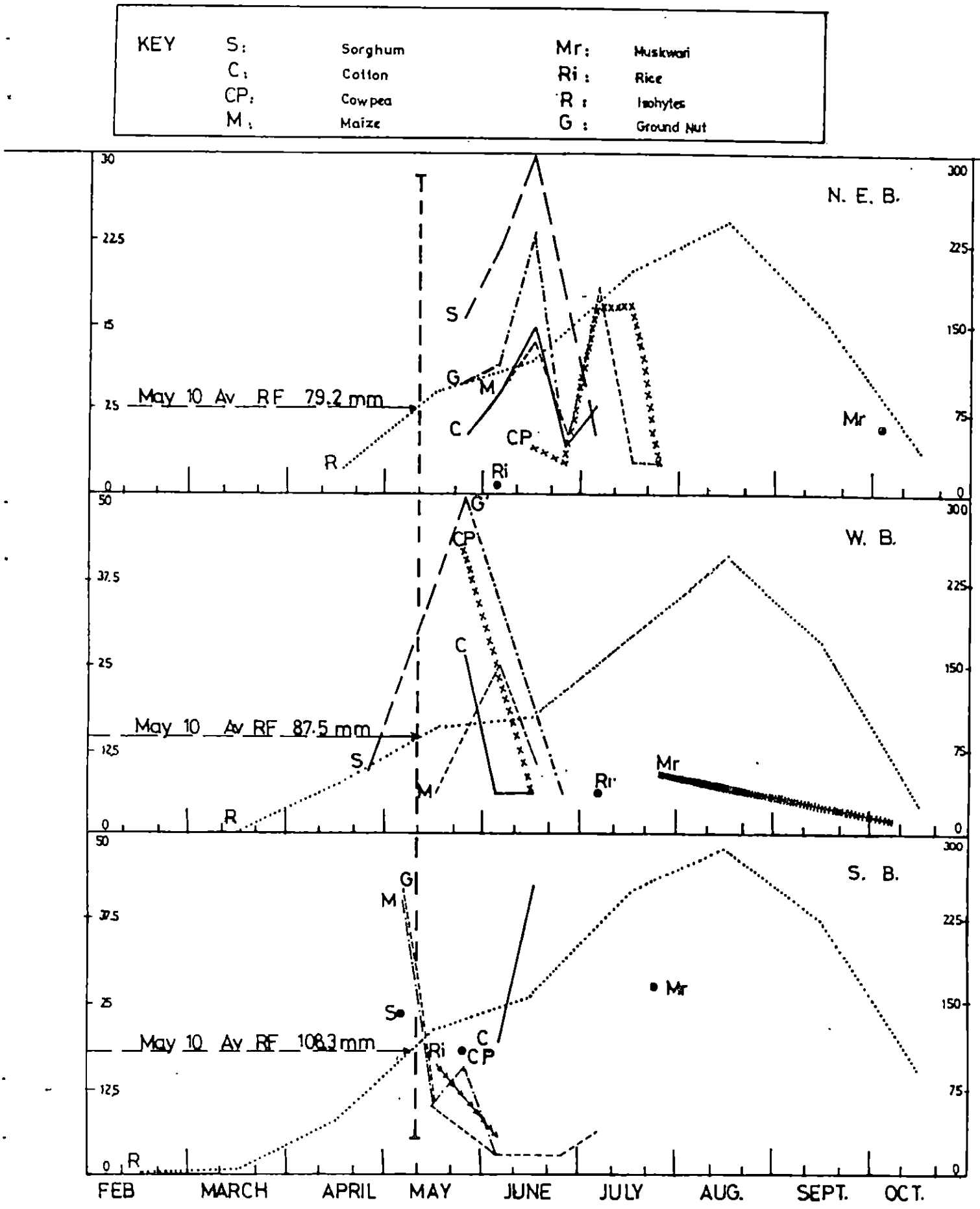
Generally in North Province, the first crops to be planted at the on set of the rains are sorghum and groundnuts followed by cotton, maize, cowpeas and other supplimentary crops like millets, sweet potatoes and vegetables. Dry season type of sorghum Muskwari, is planted towards the end of the rains. See Table 6 and Fig 4. The specific dates by regions are such that in south Benoue, 24% and 40% of the farmers there plant respectively sorghum and groundnuts in early May, then followed by maize and cotton which is planted 41% and 60% in early to Mid-June. Rice is planted in Mid-May and cowpeas at the end of May. In west Benoue region, sorghum can be planted as early as April at the on set of the first rains.

Table 6:

Farmers planting dates in North Province of Cameroon, 1986

Crop	Planting date	Percentage of farmers			
		North east Benoue	West Benoue	South Benoue	North Province
Cotton	22 - 30th May	5	26	-	8
	Early June	9	6	19	13
	Mid-June	15	6	42	22
	Late June	4	-	-	2
	Early July	8	-	-	4
Sorghum	April	-	8	-	2
	Early May	-	-	24	8
	20-30th May	16	50	-	19
	Early June	21	-	-	10
	Mid-June	30	-	-	15
	Early July	5	-	-	3
Groundnuts	Early May	-	-	40	12
	Mid-May	-	-	10	3
	21- 30th May	10	50	17	20
	Early June	12	-	-	7
	Mid June	23	-	-	11
	20- 30th June	3	6	-	3
	Early July	13	-	-	6
Maize	Early May	-	-	41	13
	Mid-May	-	6	9	6
	Early June	9	25	3	10
	Mid-June	14	11	-	9
	Late June	6	-	3	4
	Early July	19	-	6	12
	Mid-July	3	-	-	2
	Late July	3	-	-	2
Cowpeas	20-30th May	-	43	18	14
	Mid-June	4	6	-	3
	Late June	3	-	-	2
	Early July	18	-	-	10
	Mid-July	18	-	-	9
	Late July	3	-	-	2
Rice	Mid-May	-	-	17	6
	Early June	1	-	5	3
	Early July	-	6	-	2
Mouskwari	Late July	-	8	27	12
	Early October	6	2	-	4

Fig 4 PLANTING DATES USED BY FARMERS IN NORTH PROVINCE OF CAMEROON



However, 26 to 50% of the farmers in west Benoue try to plant their principal crops namely sorghum, groundnuts, cotton and cowpeas all crowded in a very short period of 20th to 30th May. In north east Benoue, Sorghum and groundnuts are usually planted from May to Mid-June, cotton planted at Mid-June, then maize and cowpeas planted early June. But probably due to the un-reliability of the rains, farmers stagger their plantings from late May to early July. Thus planting 5 or 15 up to 30% of each crop every 10 days see Fig. 4. This is perhaps intended to spread and minimise the risks of intermittent rains and/or of moisture stress. Nevertheless, the late planted fields risk complete crop failure when the rains cut off abruptly by October.

Farmers' Planting Densities

Table 7 shows farmers traditional planting population at the time of harvesting and the coresponding crop yields in North Province of Cameroon. For maize the average farmers' plant population at the time of harvesting was found to be 66 400, 33,600 and , 30978 plants/ha for north east Benoue, west Benoue and south Benoue respectively.

The sorghum plant population at the time of harvesting was found to be 54 533 and 35 400 plants/ha in north and west Benoue regions. The groundnuts fields had 77 520, 60800 and 55 000 plants/ha in north east Benoue, west Benoue and south Benoue respectively. The millet fields had generally very low plant population at the time of harvesting. However, a larger part of the north Province is not in the millet zone. Generally all the plant populations were found to be below the optimal planting densities.

Table 7 shows the corresponding crop yields from the farmer's fields. For maize, the farmers realised yields of 2.7 to 3.6 t/ha, sorghum fields yielded 1.9 to 2. 8 t/ha, groundnuts 1 to 3 t/ha and millets 1.6 t/ha. It was noted that the closer to the optimal planting densities, the better the yields obtained by farmers.

Table 7:

FARMS TRADITIONAL PLANTING DENSITY AND CROP YIELD IN NORTH PROVINCE OF CAMEROON, (1986).

Crop	Region		
	North east Benoue	West Benoue	South Benoue
	Farms' planting densities		
Maize	66400	33600	30978
Sorghum	54533	35400	...
Groundnuts	77520	60800	55000
Millets	...	43200	3685
Millets/Groundnuts in association			47900/21100
	farmers' crop yields		
Maize	3616	2851	2779
Sorghum	2855	1918	-
Groundnuts	3900	1456	1890
Millets	..	..	1683
Millets/Groundnuts in association	..	..	3068/940

Source Farm Surveys 1986.

Table 8:

AGRONOMIC PRACTICES USED BY FARMERS

IN THE REGIONS OF THE NORTH PROVINCE OF CAMEROON, 1986

Agronomic practices	Percentage of farmers						
	North east Benoue		West Benoue		South Benoue		North Province
	a	b	a	b	a	b	b
Soil Preparation							
Plough with a hoe	17	41	8	13	32	43	36
Use ox plough	30	86	13	67	17	48	76
Use tractor	2	5	-	28	5	41	21
Harrow	4	27	2	67	3	29	35
Make small mounds	13	28	-	-	-	24	32
Make ridges	1	1	-	2	-	-	1
Strip tillage	1	1	-	-	27	31	8
Tied ridges	-	2	-	-	-	-	1
Planting methods							
Plant with hoe	30	72	16	94	12	43	67
Plant by hand	18	27	16	97	15	17	38
Use seeder	2	2	-	-	-	-	-
Plant in lines	28	88	16	97	12	72	85
Plant on ridges	1	7	-	2	7	-	4
Plant with stick	9	25	2	5	2	6	15
Plant in forrow	1	-	-	2	-	-	-
Weeding and crop husbandry							
Weed with hoe	21	85	19	83	38	75	90
Make mounds at weeding	21	56	5	42	14	69	57
Make ridges at weeding	2	-	5	80	2	-	17
Mulching	1	2	-	-	-	-	1
Use herbicides	3	14	2	66	5	33	30
Apply manure	15	23	5	72	10	31	34
Weed by hand	6	36	11	72	-	-	34
Transplanting	23	55	-	8	27	53	46
Use insecticides	7	42	-	75	3	31	45

a = non cotton Farmers

b = all Farmers

Farmers' Agronomic Practices

Most farmers in North Province (76%) use ox-plough for soil preparation. About 36% dig with hoe while 21% use tractor then harrow. See Table 8. Some farmers make mounds, but making ridges is normally done about one month after planting. In Table 8 (a) represents non-cotton farmers and (b) represents all farmers. It was observed that about equal number of cotton and non-cotton farmers use ox-plough and/or dig with a hoe in each of the regions of North Province. But the farmers who use tractors and those who harrow their fields are mostly cotton farmers.

As for planting, 67% of the farmers plant with a hoe, 38% plant with a finger and 15% plant with a stick. In all the regions most farmers particularly cotton farmers plant in lines. During the weeding, 90% weed with a hoe making small mounds around the plants 57% make mounds at weeding and 17% make ridges. About 30% to 40% of the farmers use herbicides, apply fertilizers and use insecticides on their crops. About 46% of the farmers do transplant sorghum and/or maize.

Some of these agronomic practices are considered as improved techniques by farmers. For instance cotton farmers regard use of ox-plough and tractor as improved methods for soil preparations, although non-cotton farmers suggest that proper turning of the soil with a hoe is good enough. Planting in lines, transplanting, use of herbicides and insecticides are some of the improved agronomic techniques being used particularly by cotton farmers.

The crop varieties commonly used by farmers are IRCO 5028 for cotton, a white local and red local varieties of sorghum and a local variety of muskwari. For groundnuts, variety 28-206 and a local variety are used by 51% and 16% of the farmers respectively. As for cowpeas, two white seeded varieties are used by farmers.

Livestock Production

Livestock production is an important activity in North Province of Cameroon. For

Table 9.

AVERAGE NUMBER OF LIVESTOCK KEPT PER FARMER
IN NORTH PROVINCE OF CAMEROON, 1986

Type of livestock	North east Benoue	West Benoue	South Benoue	North Province
Cattle	4	14	1	6
Goats	6	7	6	6
Sheep	4	3	2	3
Donkeys	0.1	-	-	-
Horses	-	0.4	-	-
Poultry	8	7	6	7
Animal traction	1	4	0.5	1.4

Source: Farm surveys, 1986

Table 10:

SOURCE OF ANIMAL FEED FOR FARMERS IN NORTH CAMEROON

Type of animal	Source of feed	Percentage of farmers							
		South-east Benoue		West Benoue		North Benoue		North Province	
		Rainy Sea.	Dry Sea.	Rainy Sea.	Dry Sea.	Rainy Sea.	Dry Sea.	Rainy Sea.	Dry Sea.
Cattle	Grain residues	-	13	-	-	-	-	-	6
	Shrubs trees leaves	13	8	5	42	-	-	10	12
	Sorghum residues	3	10	-	8	-	-	2	6
	Groundnut residues	17	30	-	69	-	-	22	28
	Salt	1	12	67	-	-	-	13	6
	Grazing	33	1	75	17	2	2	31	4
	Hay	-	14	-	-	-	-	-	7
Goats	Grain residues	-	12	-	-	-	-	-	6
	Shrubs trees leaves	12	3	10	36	10	-	19	9
	Sorghum residues	3	17	3	3	2	-	3	9
	Groundnut residues	-	18	-	-	3	-	1	9
	Salt	1	1	3	3	3	-	2	1
	Grazing	52	-	50	11	5	17	32	8
	Hay	2	15	-	-	-	-	1	8
Sheep	Shrubs tree leaves	16	5	12	25	4	-	10	8
	Sorghum residues	4	11	11	22	7	16	6	15
	Grain residues	-	13	-	-	-	-	-	6
	Salt	2	2	14	-	5	17	5	6
	Groundnut residues	-	9	-	25	2	-	1	16
	Hay	-	-	-	-	-	22	-	-
	Bran or husks	-	25	3	6	-	-	1	13
	Grazing	36	-	42	17	14	-	30	3
Donkeys	Shrubs tree leaves	5	-	-	-	-	-	3	-
	Grain residues	-	1	-	-	-	-	-	1
	Sorghum residues	1	2	-	-	-	-	1	1
	Groundnut residues	-	1	-	-	-	-	-	1
	Hay	-	3	-	-	-	-	-	2
Horses	Shrubs	-	-	14	-	-	-	-	3
	Sorghum residues	-	-	17	6	-	-	3	1
	Hay	-	-	-	6	-	-	-	1
Poultry	Sorghum residues	24	59	19	14	-	-	16	32
	Maize residues	3	3	14	11	-	-	4	4
	Rice residues	11	12	3	6	-	-	6	7
	Grain residues	15	14	58	56	-	-	19	18
	Bran or husks	-	-	3	3	-	-	1	1
Oxen or animal trac-tion	Shrubs tree leaves	21	1	64	72	-	-	23	14
	Grain residues	-	10	-	-	-	3	-	6
	Salt	11	10	67	31	2	2	19	11
	Groundnut residues	10	14	3	72	5	2	7	21
	Grazing	-	1	-	-	24	26	7	9
	Sorghum residues	4	8	8	4	5	3	7	7
	Hay	2	8	-	-	-	-	1	4

Source: Farm Surveys, 1986.

that Province containts relatively the bulk of cattle in the country. Some farmers there specialize just in keeping cattle, while others combine both cattle keeping and crop production. For the farming population who keep both cattle and cultivate crops, on average, a family keeps 8 cattle of which 2 are oxen for animal traction, 6 goats and 3 sheep. See Table 9. However, feeding of livestock during the dry season causes a big problem to farmers who have to move the animals further south and in bottom valleys in search of grazing grounds and water. The farmers who keep oxen as a source of draught power would need some stable source of animal feed within their village settlement. Some of these farmers use various sources such as crop residues, grain husks, cutting tree leaves and making of hay. Groundnut and sorghum residues are very popular sources of animal feed. Particularly groundnut stalks are kept and given to animals when other sources have been exhausted. Farmers who have no or few livestock to feed during the dry season fetch some income by selling dry groundnut stalks. Table 10 shows sources of animal feed for farmers in North Cameroon. According to Table 10, 10 to 20% of the farmers use tree leaves to feed their cattle and/or oxen, goats and sheep even during the rainy season. The most common sources of animal feed during the dry season in various regions of North Province are groundnut and sorghum residues for cattle, goats and sheep plus grain husks as poultry feed.

Planting of Trees by Farmers

As a result of government action through the efforts of Project North East Benoue and Department of Forestry, some farmers have now become aware and recognise the economic importance of planting some type of tree species. The type of tree species being planted by farmers are Nime trees, Guaver, Eucaliptus, Mangoes, Oranges and Acacia trees. The planting of trees is more popular in north east Benoue and west Benoue where about 10 to 20% of the farmers recognise planting of trees as a very important farm activity. Table 11 shows percentage of farmers planting trees and the extent of tree planting going on in the area.

Table 11:

PERCENTAGE OF FARMERS PLANTING TREES IN NORTH PROVINCE OF CAMEROON, 1986

Type of tree planted	North east Benoue			West Benoue		South Benoue		North Province	
	% of Farmers	Hectarage by Farmers	No. of trees	% of Farmers	No. of trees	% of Farmers	No. of Farmers	% of Farmers	No. of trees
Nime trees	3	0.05	50	19	168	2	3	6 [b,d]	221
Guaver	10	0.04	55	6	47	14	70	10 [a,c]	172
Eucaliptus	1	0.01	-	22	231	-	-	5 [b,e]	231
Orange trees	9	0.05	45	-	177	-	34	- [a]	256
Mangoes trees	9	0.02	68	11	175	21	22	13 [a,c]	265
Acacia al Bida	1	-	85	14	288	2	1	4 [b,d,e]	374
Papaya trees	-	-	-	-	-	9	72	3 [a]	72
Acacia Tchaski	-	-	-	11	12	-	-	2 [b]	12
Lime trees	9	0.005	45	8	177	14	34	10	256
Banana trees	-	-	-	-	-	9	239	3 [a]	239
Anacardia trees	-	-	-	11	24	-	-	2 [b]	24
Flaming trees	-	-	-	14	24	-	-	3 [b]	24
Albrigia trees	-	-	-	3	12	-	-	1	12
Cayas trees	-	-	-	3	20	-	-	1 [b]	20

Farmers reasons for tree planting: (a) =Fruits, (b) = Stop desert, (c) = animal feed, (d) = provide shade and (e) = provide wood.

Source: Farm Surveys, 1986.

Table 12:

RELATIVE IMPORTANCE OF MAJOR FOOD CROPS, ACCORDING TO FARMERS PREFERENCES.

Food crop	Weighted scores for prefered food crops			
	North east Benoue	West Benoue	South Benoue	North Province
Red sorghum	5.27	3.11	2.5	3.98
Maize	2.6	4.6	5.15	3.79
Groundnuts	2.73	3.67	3.48	3.19
Muskwari	1.35	1.47	2.89	1.85
Cowpeas	1.73	1.17	0.83	1.34
Rice	1.08	0.42	1.82	1.18
Millets	0.12	0.14	0.1	0.08
Yams	0.6	0.1	0.1	0.36
Irish potatoes	0.58	-	0.17	0.34
Cassava	0.4	0.13	0.1	0.24

Source: Farm surveys, 1986.

Table 11 also column 9 shows different reasons why farmers like to plant trees. The main reasons marked by a,b,c, column 9 for planting trees by about 20 to 30% of the farmers are (a) to provide fruits, (b) stop of desert encroachement (c) as a source of animal feed (d) provide shade and (e) to provide wood.

Farmers' food crop Preferences

Farmers were asked to rank from one to six, in their order of importance and/or preference of the major food crops. When a farmer gave rank one to a food crop say sorghum, this was then given score 6, the crop ranked number two by a farmer, was given the score 5, descending downwards till the crop ranked number six was awarded the score of 1. All the scores of a particular food crop were weighted together for all the farmers interviewed. Table 12 showsthe outcome of such weights thus indicating the relative importance of each food crop to farmers in the region. According to Table 12 red sorghum, maize and groundnuts are the most important food crops with scores of 3.98; 3.79 and 3.19 respectively followed by muskwari (a dry season sorghum), cowpeas and rice which have scoresof 1.85, 1.34 and 1.18 respectively. food crop with a score above unity is significantly important to farmers whereas a food crop withscores less than unit is of less economic importance.

Looking at the market prices say during the planting period May/june, suggest how scarce some of the prefered food crops can be. Table 13 shows a comparison of farmers' selling and buying prices of food crops during the hungry/lean period May/June 1986 and the offical government buying price at harvest in Oct/Nov. 1986. Among the crops grown in the region, sesame and groundnuts fetch very high prices of 400 and 287 CFA per kg in the market during the lean period of planting. But fetch less than 30% of that price at harvest. Rice, cowpeas and red sorghum are also quite expensive during the lean period and their prices fall to less than half at harvest. The crops which are not grown in the area such as yams, bananas, potatoes, cassava, millets have always high prices due to transportation and handling costs.

Table 13:

A COMPARISON OF FARMERS' SELLING AND BUYING PRICES OF FOOD CROPS IN NORTH PROVINCE OF CAMEROON,1986.

Crop	Farmers selling price May/June 1986 CFA per kg	Farmers Buying price May/June 1986 CFA per kg	Cereals office Buying Price Oct. 1986 CFA per kg
Groundnuts	133	287	80
Red sorghum	132	125	65
White sorghum	108	111	70
Maize	103	111	60
Sesame	187	400	-
Bambara-nuts	125	-	-
Cowpeas	225	222	90
Tice	187	219	-
Sweet potatoes	100/heap	275/heap	-
Millets	225	150/Cup	-
Cassava	100/heap	117/heap	-
Bananas	200/heap	-	-
Cocoyams	200/heap	660/heap	-

Source: Farm surveys, 1986

Farmers' Production constraints

One of the main objectives of this socioeconomic study in North Province of Cameroon is to assess the farmers' production constraints. In this regard three approaches were used. (i) by incorporating in the questionaire, instruments for collecting various farm data as visual stature of the soil, scores to indicate general plant growth including occurences of moisture stress, scores to indicate extent of damage by insects, diseases and level of crop management including planting dates, crop yields, rainfall etc... This farm data is then analysed by fitting a production function the apportioning the error term or estimating the in-put-output matrix and observing the signs of the coefficients and/or apportioning yield losses to various observed factors. (ii) The second approach to constraints assessment is apart from collecting farm data, researchers can interact with the farmers through out the agricultural season and ask them (farmers) to point out the first and second major production constraints that the observe on their fields. (iii) The third approach to constraints assessment is for a team of data collectors to make field observations along with farmers and each to score observed factors that could be responsible for large losses of crop yields

Using a combination of approaches, the following major production constraints were identified in Northern Cameroon, thus:

1. Poor soils and declining soil fertility.
2. Drought and/or prolonged dry spells at the time of planting.
3. Moisture stress at various stages during the cropping season.
4. Lack of appropriate small farm tools to circumvent critical periods of land preparation and planting in order for farmers to cop with the shortness of the agricultural season.
5. Insufficient farm cash income to buy purchased inputs and
6. Crop diseases.

Agricultural production constraints identified by using approaches two and three are shown in Table 14 and 15. Table 14 shows the major factors causing 10 to 20%

Table 14:

MAJOR FACTORS CAUSING 10% TO 20% CROP YIELD LOSSES IN 1983, 1984 AND 1985.

Factors causing yield losses	Crop affected	Percentage of farmers			
		N.E.B.	W.B	S.B.	North Province
Poor soils	Maize	2	11	9	6
	Groundnuts	3			
	Cotton	1			
Drought	Maize	3	83	-	36
	Sorghum	11	88	-	27
	Mouskwari	-	19	-	-
	cowpeas	-	8	-	-
	Groundnuts	-	86	-	-
	Cotton	2	89	-	18
	Rice	-	-	2	6
Moisture stress	Maize	12	27	31	21
	Sorghum	50	22	9	32
	Mouskwari	1	8	14	6
	Cowpeas	8	-	6	5
	Groundnuts	31	58	26	35
	Cotton	14	19	9	13
	Rice	-	2	2	-
Diseases	Maize	-	89	3	32
	Sorghum	24	89	31	43
	Groundnuts	4	75	29	26
	Cotton	-	17	18	12
Late planting	Maize	5	50	27	21
	Sorghum	6	44	12	15
	Groundnuts	8	11	26	14
	Cotton	3	30	19	13
Poor Germination	Maize	-	33	3	-
	Groundnuts	3	8	-	3
	Cotton	1	14	-	3

Table 15: (a) & (b)

(a) PRODUCTION CONSTRAINTS AND (b) FREQUENT CAUSES OF FOOD SHORTAGES POINTED OUT BY FARMERS IN NORTH PROVINCE OF CAMEROON, 1986

	Percentage of farmers				
	North East Benoue	West Benoue	South Benoue	North Province.	
				a	b
Insufficient rains	4	-	-	2	39
Drought and poor soils	9	11	-	6.5	13
Lack of transportation	3	36	5	10	
Insufficient farm cash income to purchase inputs	4	33	53.5	25	
Inavailability of imported fertilizer and insecticides	23	28	7	19	
Inavailability of farm tools like ox-plough, tractor.	33	72	62	49.5	1
Lack of credit facilities	1	11	-	3	
Lack of technical advisory service.	3	5.5	9	5	
Crop diseases	5.5	36	5	11	3
Obnoxious weeds like striga	2	-	36	11	1
High price of seeds	1	28	-	6	
Lack of farmers' cooperatives	6.5	-	-	3	

Source: Farm surveys, 1986

crop yield losses in North Province of Cameroon. According to Table 14, poor soils have been affecting mainly maize, groundnuts and cotton since 1983 to date. But drought and moisture strees have been the major constraints in the area and have affected all the crops especially during 1983, 1984 and 1985 seasons.

In 1984 and 1985, the production for about 20 to 30% of the farmers was adversely affected by drought and moisture stress. Various crop diseases, late planting and poor germination affect mostly maize, sorghum, groundnuts and cotton for respectively 20 to 40%, 13 to 20% and 3% of the farmers.

Table 15 shows production constraints pointed out by farmers in the North Province of Cameroon. According to the farmers, inavailability of farm tools like ox-plough, tractor, planters etc... is their number one constraint and insufficient farm cash income to purchase inputs is their number two constraint. Other major constraints pointed out by farmers are inavailability of imported fertilizers and insecticides, crop diseases, striga weeds, lack of transportation and drought.

During the study, each farmer was also asked whether he had experienced food shortage in his family during the previous year and if so to point out a factor (s) that could have caused the shortage. According to the farmers lack of rains was the most serious cause of food shortage. Table 15, column five b shows causes of food shosrtages. Farmers also suggested that drought, poor soils, crop diseases, and crop failure have been causes of food shortages. The methods used by farmers to circumvent food shortages in North Province of Cameroon include selling domestic animals, buying food from market, obtaining help from friends and shifting to fresh land/settlement all together.

Some adjustment mechanisms when faced with certain constraints.

It has been observed during the study that farmers have different ways of making adjustments when they are faced with certain constaints. For instance when farmers

Table 16:

FARMERS ADJUSTMENT MECHANISMS FOR SOIL WATER CONSERVATION IN NORTH PROVINCE OF CAMEROON, 1986

PERCENTAGE OF FARMERS

METHOD	NORTH EAST BENOUE		WEST BENOUE		SOUTH BENOUE		NORTH PROVINCE	
	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)
Proper ploughing	98%	13%	100%	40%	100%	22%	99%	38%
Mulching	3%	2%	-	-	-	-	1%	1%
Watering rows to supplement rain water.	1%	1%	-	-	-	-	1%	1%
Strip tillage	3%	2%	-	31%	43%	-	15%	11%
Terracing	1%	-	-	2%	3%	-	2%	1%
Ridging	-	-	72%	-	-	3%	14%	1%
Tied ridging	2%	-						1%

(a) = all farmers

(b) = non cotton farmers

Source: Farm Surveys, 1986.

find themselves in situation of food shortage before the next harvest, they may fall back to selling domestic animals and buy supplementary food from the market or start some type of non-farm activity like selling firewood which is scarce in the region or start petty trade, call for help from friends or shift all together to new settlements in the Benoue Valley.

In response to drought and moisture stress, farmers believe that proper ploughing of the soil helps to conserve soil water. Other measures used by farmers to conserve water in North Province are strip tillage, ridging, terracing and mulching. Table 16 shows percentage of famrers responding to soil moisture constraint by making certain adjustment mechanisms. In response to soil fertility problem, which is compounded by inavailability of fertilizers, farmers use their chemical fertilizers only on their most important crops namely cotton, maize and groundnuts. Some farmers use manure and/or crop residues as sources of fertility particularly on maize and red sorghum crops. (Table 16).

RESULTS OF TECHNOLOGY EVALUATION

Implementation strategy of the agronomic trials.

Since the research priorities of SAFGRAD-FSR Cameroon Project are based on the already identified agricultural production constraints and the rural needs of small scale farmers in the North Province of Cameroon the implementation strategy in 1986 was to (i) conduct research managed trials on farmers field (ii) conduct on-farm trials on collaboration with development agents, extension workers and farmers. The on-farm trials involve one to three levels of management (including soil fertility, soil conservation, water management and crop management). During the year 1986/1987 a total of 94 field experiments carried-out and 83 (88%) were succcessfully harvested, see Table 17.

Summary of field trials conducts in 1986 cropping season in the Northern part of Cameroon.

Table 17

S.N.	Title of Trials	N° of Trials proposed	N° of Successful Trials	% Success
1.	Fertilizer and manure trials	2	2	100.00
2.	Soil moisture conservation study on maize production	14	10	71.43
3.	Soil moisture conservation study on sorghum production.	14	10	71.43
4.	Maize density trials	12	12	100.00
5.	Maize variety trials	24	22	91.67
6.	Sorghum variety trials	6	5	83.33
7.	Groundnut variety trials	22	22	100.00
	Total	94	83	88.30

Comparative study of Animal Manure and Chemical Fertilizer in two different types of Soils with Maize (Researcher Managed).

Objectives:

(i) The main objective of this study is to find-out the effectiveness of animal manures alone and in combination with chemical fertilizer on crop production and maintenance of soil fertility in sudano-sahelian zone of North Province of Cameroon.

(2) Find-out the economics of the use of animal manures as compared to chemical fertilizers.

No doubt chemical fertilizers are becoming almost an essential part for boosting the crop yields especially with the development of improved technologies of crop production. However, the use of chemical fertilizers by farmers in the developing countries is considered to be one of the costly input especially with small scale farmers. Among zeveral reasons of less use or no use of chemical fertilizers by small scale farmers to food crops are lack of purchasing power and oftenly non availability of fertilizers in sufficient quantity and at appropriate time.

The use of chemical fertilizers in arid and semi-arid regions with low rainfall and soils of low fertility levels and chemically fragile having low or poor buffering capacity should be taken into consideration. It is a proven fact that heavily fertilized crop suffered more if moisture becomes deficit or drought occurs during the peak period of growth as compared to non-fertilizered or moderately fertilized crops. Also the continuous use of chemical fertilizers causes deficiencies of other secondary and micronutrients if fertilizers are not use in balanced form. It also causes soil acidity or salinity/alkalinity depending on the types of chemical fertilizer used.

Earlier work on the use of organic manure (compost and animal manures) are not very conclusive. During the year 1966-1967 some work on use of the organic maure was done with Muskwari sorghum at Salak (near Maroua). The results indicate a very matginal increase in yield upto 9% was obtained over no use of any fertilizer or organic manures, (IRAT 1967). In this trial it is not clear how organic manure was applied to vertisol when transplanting is done manually at a depth of 20cm. Also the heavy clay soil (vertisol) which are normally rich in nutrients and yield potential of Muskwari sorghum is low at present may not respond much to additional nutrients. However, this work would have been tried few more years and also the techniques of application and incorporation of compost etc,,.should have been worked-out.

During the years 1968 to 1981 several trials were carried-out with the use of organic manures using cotton as a test crop. The results reported (Dubernard, 1971-72 on the yield of cotton with the use of organic manure at Guiring (Maroua) was non-significant. Further, the use of a combination of 20 tons of Organic manure plus 100 kg Urea + 200 kg Bicalcium phosphate gave cotton yield upto 2398kg/ha which is compareable to the yield obtained with 20 tons organic manure alone (2249 kg/ha) at Maroua (Dubernard & Bisson 1972-73). Gigou (1978) who reported the result of cotton yield as affected by the use of 10 tons of organic manures indicate that first two years the effect of organic manure was not pronounced but later years the effect of organic manure was quite noticeable. The trial was conducted at Maroua. Experiments with maize on the use of organic manure were carried at Maroua, (Guiring), Sanguere and Soucoundou during the years 1974-1979 indicate that at Sanguere and Guiring the effect of 5 tons of organic manure gave better results when applied along-with 120 kg N plus 90 kg each of P_2O_5 and K_2O/ha. However, the result at Soucoundou was not very consistent due to water logging of the field, (Rosett, 1981).

So far the result obtained were mostly on the cotton which has a tap root system and may not be very effective to use the organic nutrients applied on the surface few cm (15cm).

Also the aplication of organic manure along-with cotton fertilizer 20-10-10 or similar may increase the vegetative growth rather than increasing the cotton yield. Not much information is available on the use of organic manures on cereal crops (maize and sorghum) in the light sandy soils and its effect on the maintenance of soil fertility or re-generation of degraded soils which are very common in the Northern part of Cameroon.

The use of animal manures though it is bulky to handle have long term beneficial effect. Fortunately, North Province of Cameroon has a high population of different cattle yet the use of animal manure and its beneficial effect has not reached

to the substensive farmers. Oftenly, it has been observed that farmers used to shift the animal from one place to another around their house rather than taking the animal droppings to their field and store it properly for further decomposition and to avoid losses of nutrients and then finally to use in their field.

The idea for conducting this trial came little late and also there were lack of resources. However, with the help of SODECOTON and our observators in the fields we managed to get two locations having different textural class of soil. The two locations were Ngong in west Benoue and Badjouma Centre in north east Benoue regions of SODECOTON in the North Province of Cameroon. The soil at Badjouma is clay loam and Ngong is sandy soils.

Method:

After prparing the land at Badjouma with oxen plough and at Ngong with small tractor, experiments at both places were laid out on 16th July, 1986 with six randomly selected treatments with four replications. The statistical design followed at both places was complete randomized bolck design. Planting of maize (Var. Safita) was done on 17th July, 1986 at both the places following row distance of 80 cm & plan to plant distance 20 cm (plant population of 65,500/ha. Manure and fertilizers were applied before planting according to treatments and were incoporated in the soil by local hoes. Full dose of manure was applied and incorporated into the soil in animal manure treatment plots where as in nitrogen treatment plot half of N was applied at planting and the remaining half after 4 weeks at the time of first weeding. Unfortunately, we could not add an absolute control plot in the design mainly because of cereals which normally gives very poor yields or some times no grain yields especially maize in very poor and sandy soils.

Results and Discussion:

Soils data has already been given in Table 19 and had been discussed in the soil moisture conservation trials of Ngong and Badjouma.

Gain yields of maize presented in Table 18 indicate that in general, yield at Badjouma is higher than that of Ngong. It appears that it is mainly due to initial high fertility level at Badjouma as compared to Ngong. Yield trend is very similar at both the places. The yield obtained with 100 kg N/ha was almost the same as obtained with 5 tons of animal manure plus 50 kg N/ha at both the places. Although no conclusion can be drawn with one year's data but it appears that application of animal manure can be subsituted for chemical fertilizer to some extent which could be beneficial in the long run.

Grain yield of late sown maize in two different type of soils under different animal manure and fertilier levels.

Table 18

Treatments	Grain Yield (kg/ha)			
	Badjouma		Ngong	
Animal manure (5 tons/ha)	2 732	C *	1 116	C *
Animal manure (10 tons/ha)	2 963	C	1 287	C
Nitrogenous fertilizer (50 kg N/ha)	3 866	ab	1 548	bc
Nitrogenous fertilizer (100 kg N/ha)	4 144	a	2 366	a
Animal manure 5 tons + 50 kg N/ha	3 334	bc	1 897	ab
Animal manure 5 tons + 50 kg N/ha	4 098	a	2 314	a
Total rainfall during the cropping period (17-7-86 to 29-10-86) (mm)	645.8		521.1	

* Figures in the same column followed by different letters are significantly different from each other.

Table 19.

Initial soil test values of experimental sites at Badjouma and Ngong

Soil Parameter	Badjouma	Ngong
Soil pH (water)	6.50	6.20
Org. C. (%)	0.90	0.60
Total - N (%)	0.081	0.053
C/N ratio	11.11	11.32
Exch. Cations (Meq/100 g)		
Ca	6.33	1.62
Mg	2.08	0.44
K	0.31	0.11
Na	0.10	0.03
CEC (meq/100 g)	8.82	2.20
Available - P (ppm)	12.09	6.76
Mechanical analysis		
Sand (%)	66.3	81.2
Silt (%)	18.4	12.6
Clay (%)	15.3	6.2

Soil Moisture Conservation Study

Objectives:

(1) To study the effect of flat, ridging and tied ridging on soil moisture conservation and crop yield in the sudano-sahelian zone of North Cameroon.

(2) To study the economics of flat, ridging and tied ridging.

(a) Soil Moisture Conservation in two different types of soils with late sown maize

In sudano-sahelian zones of Africa in general, and semi-arid and arid zones of North Cameroon in particular, it has always been a problem of rain water conservation for the crop to complete its life cycle. Some times there is heavy rain which soils can not hold and it creates the problem of surface run off vis - a - vis causes soil erosion.

The two problems, moisture conservation and to avoid surface run-off which is linked with soil erosion by water has to be tackled simultaneously. Several techniques of soil moisture conservation in different parts of sudano-sahelian zones have been suggested by several researchers but the problem vary from place to place depending on the several factors such as topography of the soils texture and structure of soil, rainfall and its distribution, crop and cropping systems followed by soil cover, soil depth and so many other factors.

In the past efforts have been made by several scientists and Research organisations to work-out a suitable technique(s) to conserve the soil moisture in the sudano-sahelian zones of Africa and elsewhere. Results from experimental station trials have shown that tied ridges can result in significant cereal yield increases compared to flat cultivation or simple ridging (odriquez 1982, ICRISAT 1982, IRAT 1983) but the amount of crop yield response has been variable. Crop yield response to tied ridging is general greater when soil fertility is less limiting (Rodriguez 1982, FSU/SAFGRAD 1983/1984, and SAFGRAD/IITA 1985). Dugue (1985) has suggested that in Yatenga (Burkinafaso) area farmers must be initiated to tied ridging which must be done just after tillage. Work carried-out in Cameroon (Talleyrand et al 1986) on tied ridging with maize and sorghum crops are not yet conclusive. However, it has been suggested that tied ridging is beneficial under certain sets of condition (climate, soils etc...).

Work carried-out by Nicou and Charreau (1985) suggests that no technique is universal and that each of them must be adapted to the context. Indeed, it is observed that each of them depends on (i) the soil (texture, structure, depth, fertility) (ii) the climate (total rainfall, distribution) (iii) the vegetation and (iv) farming practices.

A single technique or techniques of soil moisture conservation cannot be generalised and adopted everywhere in the sudano-sahelian zone.

One has to work out a technique (s) which suits to the locality. With this idea two experiments at two different sites having different soil textures were selected for late planted maize of short duration (95 days) and several trials on farmers field. The two sites selected for late planted maize were one at Ngong sector of west Benoue and the other at Badjouma Centre (Pitoa sector) of north east Benoue region of North Province of Cameroon.

Method:

Field at Badjouma was prepared on 15th of July 1986 with oxen plough and planting was done on 17th of July by manual labour. At Ngong it was difficult to get oxen so the land was prepared by tractor and planting was done on 17th July 1986. The variety Safita was selected as a test crop for both the places since it matures in 95 days. The experiments at both the places were carried out in randomised complete block design with 4 replications. Planting distance was 80 cm from rows and 20 cm from plant to plant with one plant per stand (plant population/ha was 62 500). Fertilizer at recommended rate was applied at the time of planting and Urea was aplied after 4 weeks of planting when ridging and other treatments were imposed.

In all six different treatments that were tried this year, and if need arises additional treatments may be tried in the next cropping season depending on the resources available on researchers disposal.

Results and Discussion:

Soils of the two locations are quite different in texture and nutrients status as given in Table 19. Soil analysis data indicate that soil at Ngong is quite sandy in nature, low in exchangeable cations and cation exchange capacity and quite low in available phosphorus and total nitrogen. Soil at Badjouma is quite heavy with higher cation exchange capacity and exchangeable cations, organic carbon, total N and available - P.

Grain yields which is presented in Table 20 reveals that alternate tied ridging at Badjouma gave slightly higher yield as compared to the other treatment. Visual observertion in the field indicated that the close tieing of the ridges at 2m interval or 3m interval caused water logging in the heavy soil of Badjouma on one hand, and complete or partial surface run off of rain water in flat and ridged plots. However, in the heavy soils of Badjouma there were no significant yield differences.

Results of maize grain yield at Ngong which is sandy soils gave entirely a different type of results. The lowest yield was obtained with flat planting and highest with tied ridging at 2m interval after one month of planting (Table 20). Since this is the first year's results; no concrete conclusion can be drawn but one thing is clear that flat planting or ridging or tied ridging in order to conserve soil moisture will be specific to location, soil type, rainfall patterns and so many other factors. Similar observations were also made by the scientists working at Burkina Faso for several years (SAFGRAD/IITA annual report 1985).

Table 20.

Grain yield of late sown maize in two different types of soils under different moisture conservation techniques.

Treatments	Grain yield (kg/ha	
	Badjouma	Ngong
Flat planting and no ridging	2 963 a *	1 667 c *
flat planting + small bunding around the plot	3 079 a	1 979 bc
Flat planting + ridging after one month of planting	2 963 a	2 418 abc
Flat planting + tied ridging at 2m interval after one month	2 871 a	2 924 a
Flat planting + tied ridging at 3m interval after one month	2 593 a	2 418 abc
Flat planting = alternate tied ridging at 3m after one month	3 519 a	2 634 ab
L.S.D. (0.05.p)	1 189	769
C.V. (%)	26.3	21.8
Total rainfall during crop period (17-7-86 to 29-10-86) (mm)	645.8	521.1

* Figures in the same column followed by different letters are significantly different from each other.

(b) Soil Moisure conservation trials on farmers field

(i) Maize

1. Researccher managed

Four replicated trials were proposed during the year 1986/1987 cropping season in collaboration with SODECOTON out of which only two were successful and other two were failed due to some logistic reasons.

The proposed trials consisted of four different treatments namely (i) planting on flat (ii) planting on flat and ridging after one month of planting (iii) planting on flat and tied ridging after one month of planting at 2m interval and (iv) same as (ii) but ried ridging was done at 4m interval.

Grain yield data presented in Table 21 indicate that there were no significant

Table 21

EFFECT OF FLAT, RIDGING AND TIED RIDGING ON MAIZE YIELD UNDER RESEARCHERS AND FARMERS MANAGED CONDITION, 1986

Treatments	Grain Yield (kg/ha)									
	Researcher Managed			Farmer Managed						
	Hama Koussou	Tchollire	Mean	Hama Koussou	Ngong	Baikwa	Bibemi	Tchollire	Mean	% increase over flat
Flat	1984	2027	2006	937	2117	3498	1501	2797	2161	-
Ridging	1927	1424	1676	790	3315	4102	1400	4875	2966	37.3
Tied ridging (2m interval)	2057	1331	1694	438	2643	3178	1350	4570	2470	14.3
Tied ridging (4m interval)	2104	1158	1631	-	-	-	-	-	-	-
L.S.D (0.05 p)	604	966	N.S.	L.S.D. (0.05 p) for sectors mean 826, Treatment - N.S.						

* In the case of farmers managed trial, interval of tieying was 3m.

difference between various methods of soil moisture conservation. The area where these two trials were laid-out had received quite sufficient rainfall during the cropping season and no moisture stress was observed. Also soils at Hama Koussou were quite heavy and at Tchollire it was loamy soil. Ohm et al (1985) suggested that variable responses from tied ridging is undoubtedly due to several interacting factors, including level of soil fertility, amount and frequency of rainfall, moisture stress, soil type, topo-sequence, crop growth stage when tied ridging was done etc...

2. Farmers managed

Three simple treatments were tested on the farmers field at different sectors and sites. In the analysis of such experiments sites and number of rows harvested were treated as replications.

Out of 9 trials proposed only 6 were harvested successfully in the North Province of Cameroon. The three simple treatments were (i) flat planting (ii) flat planting and ridging after one month of planting and (iii) flat planting and tied ridging at 3m interval after one month of planting.

Results on grain yield of maize presented in Table 21 indicate that ridging after one month of planting has given higher yield at Ngong, Baikwa and Tchollire whereas there were no yield differences at Hama Koussou and Bibemi. However, ridging has given an increase in mean yield of 37.3% and tied ridging 14.3% over flat respectively (Table 21).

(ii) Sorghum

1. Researcher managed

Similar to maize, trials with sorghum were also carried out at four different locations in North Province of Cameroon during the year 1986. The treatments remains the same as of maize.

Table 22

EFFECT OF FLAT RIDGE AND TIED RIDGES ON YUIELD PERFORMANCE OF SORGHUM UNDER RESEARCHERS AND FARMERS MANAGED TRIALS IN NORTH PROVINCE OF CAMEROON, 1986

Sectors	Grain Yield under different treatments (kg/ha)				L.S.D.
	Flat	Ridging	Tied ridging (2m interval)	Tied ridging (4m interval)	(0.05p)
A. Researcher Managed					
Mayo-Oulo	517	757	574	715	215
Hama Koussou	1966	2000	2132	1943	303
Ngong	2259	2561	2519	2469	280
Pitoa	1365	1228	1435	1185	292
Mean	1527	1636	1665	1578	291
B. Farmer managed					
Djalingo	2826	2436	1777	-	
Hama Koussou	1580	1771	1735	-	
Baikwa	1736	2002	2233	-	
Bibemi	1167	1253	1296	-	
Paderme	1176	968	790	-	
Pitoa	2278	3506	3383	-	
Mean	1785	1989	1869	-	
L.S.D (0.05p) for sector mean 194 and for treatment mean 137					

* Tied ridging in farmers managed trials was at 3m interval

Results presented in Table 8 indicate that there were no yield difference with different treatments. However, there was little advantage of ridging and tied ridging a 2m was observed as far as sorghum yield is concerned (Table 22).

2. Farmers managed

These types of trials were very similar to that of maize. The treatments remain the same as of maize. Several trials were conducted in different sectors in North Province of Cameroon during the year 1986.

Results of sorghum yield presented in Table 22 indicate that there is no significant difference between different treatments. However, at Pitoa, ridging was found to be beneficial where as at Djalingo, flat planting was found to be the best. Cereal crop yield response to tied ridging in farmer-managed trials has generally been low (FSU/SAFGRAD, 1982, Long et al, 1983 Rodriguez, 1982) than in experiment station trials. Since this is the first year, no conclusion can be drawn and this type of trial has to be repeated at least 3-4 years taking in to account the type of soils, topography,rainfall distribution and cropping period.

Maize population and density Trial (Farmers managed)

Objectives: (1) To study the best planting distance and plant population of maize in North Province of Cameroon under farmers condition. (2) Pass-on the recommendations to the extension agency if appropriate, if not then provide the feedback information to station researcher for modification;.

Maize is becoming a popular crop in the southern part of North Province of Cameroon. There had always been a lot of controversy among scientiests, researchers and extension workers on the optimum plant population for optimum maize yield. So far a plant population of 62 500 plants/ha (80 x 20 cm planting with one plant per stand) was being advocated by researchers based on their findings on the research farms. There was another suggestion of 80 cm x 40 cm with two plant per stand. Well in a way it sounds more practicable from farmers point of view because farmers plants 2 to 3 plants per stand at wider spacing. Some scientists are of the view that we should increase the plant ppopulation to 83 333 plants per hectare by putting 2 plants per stand with 80 cm x 30 cm or 80 x 15 cm with one plant per stand.

Methods :

In order to test all the hypothesis, 12 trials on farmers field in west Benoue and south Benoue were carried-out which were managed by the farmers. Four different planting distance cum plant population treatments were tested at each site. The four treatments were:

1 - 80 x 40 cm planting distance with two plants per stand (62 500 plants/ha)

2 - 80 x 20 cm planting distance with one plant per stand (62 500 plants/ha)

3 - 80 x 30 cm planting distance with two plants per stand (83 333 plants/ha)

4 - 80 x 15 cm planting distance with one plant per stand (83 333 plants/ha)

Maize variety TZPB K-81 was used for this test in both regions with the optimum level

of fertilizer application (90 kg N, 20 kg each of P_2O_5 and K_2 O/ha). At each location 0.25 ha area was selected for the. trial.

Except fertilizer all other inputs were supplied by SAFGRAD, IRA. Labour was supplied by the farmers and their families. The total produce of the field was returned to the farmers after taking the data and observation. Harvesting was done with six seperate lines in each of 4 treatments in order to see the variability within the treatments. One row sample ($40m^2$) from each treatment was taken to findout the shelling percentage.

Results:

West Benoue

Results or grain yield and plant population presented in Table 23 clearly indicate that no farmer has achieved the theoritical population and it is practically not possible even on the experiemental farm. However, many of the farmers have achieved a plant population upto 80 percent of the theoritical plant population.

Grain yield clearly indicate that planting distance of 80 x 40 cm with two plants per stand is always inferior than other treatments. Yield difference between 80 x 20 cm with on plant per stand and 80 x 30 cm with two plants per stand were not significant in any sector of West Benoue (Table 23). The overall mean of the sectors also indicate that planting of maize at 80 x 15 cm with one plant per stand gave significantly higher yield than other three treatments.

South East Benoue

The similar trials as of west Benoue were carried-out in south Benoue. It is worth to point-out that South East Benoue have more and extended rainfall as compared to west Benoue. At some locations within the sector, the plant popuplation was quite low which has affected the yield .

Table 23:

YIELD PERFORMANCE OF MAIZE VARIETY TZPB-K81 UNDER DIFFERENT PLANTING DISTANCE AND POPULATION IN WEST BENOUE, (1986)

Treatments	SECTORS							
	Hama Koussou		Ngong		Poli		Mean	
	Yield kg/ha	Plant population/ha	Yield kg/ha	plant population/ha	Yield kg/ha	plant population/ha	Yield kg/ha	Plant Pop/ha
80 x 40 cm (two plants/stand)	3 648	52 300 (62 500)	2 556	56 750 (62 500)	4 748	30 200 (62 500)	3 650	47 888 (62 500)
80 x 20 cm (one plant/stand)	4 000	54 500 (62 500)	3 237	48 600 (62 500)	5 522	47 650 (62 500)	4 190	51 313 (62 500)
80 x 30 cm (two plant/stand)	4 090	62 175 (83 333)	3 366	58 350 (83 333)	5 104	43 750 (83 333)	4 163	56 588 (83 333)
80 x 15 cm (one plant/stand)	4 688	64 000 (83 333)	3 488	56 100 (83 333)	6 505	43 600 (83 333)	4 842	56 925 (83 333)
Mean	4 106	58 244	3 162	54 925	5 470	41 300	4 211	5 317

L.S.D for mean yield of planting distance within sectors is 601

Note: Figures in perenthesis indicate the theorical plant population/ha

Table 24:

YIELD PERFORMANCE OF MAIZE VARIETY TZPB - K81 UNDER DIFFERENT PLANTING DISTANCE AND PLANT POPULATION IN SOUTH EAST BENOUE, (1986).

Treatments	SECTORS									
	Madingrin		Sorombeo		Tchollire		Touboro		Mean	
	Yield kg/ha	Plant Pop./ha	Yield kg/ha	Plant Pop./ha	Yield kg/ha	Plant Pop./ha	yield kg/ha	Plant Pop./ha	Yield kg/ha	Plant Pop./ha
80 x 40 cm	4 980	not counted	4 932	35 350	4 248	47 950	4 522	49 825	4 670	44 375
(two plant/stand)				(62 500)		(62 500)		(62 500)		(62 500)
80 x 20 cm	4 749	not counted	4 326	50 225	4 677	52 950	4 731	44 325	4 621	49 167
(one plant/stand				(62 500)		(62 500)		(62 500)		(62 500)
80 x 30 cm	3 954	not counted	4 265	39 375	4 010	71 575	4 087	48 575	4 079	53 175
(two plant/stand				(83 333)		(83 333)		(83 333)		(83 333)
80 x 15 cm	5 104	not counted	4 650	44 675	5 090	64 675	4 895	49 750	4 935	53 033
				(83 333)		(83 333)		(83 333)		(83 333)
Mean	4 697		4 543	42 400	4 506	59 288	4 559	48 119	4 576	49 938

L.S.D. overal mean yield of treatment 303

Note: Figures in parethesis indicates the theoritical plant population per hectare.

As far as the yield is concerned (Table 24) the trend is quite different than that of west Benoue. In this region the yield between 80 x 40 cm with two plants per stand and 80 x 20 cm with one plant per stand was almost the same (mean value). Yiled with 80 x 30 cm with two plants per stand was lower than other three treatments. However, the mean yield with 80 x 15cm with one plant per stand was found to be better than the other three treatments (Table 24).

Comments and Conclusion

1 - This is the first year of this trial and no concrete conclusion can be drawn.

2 - It is interesting to note that planting distance of 80 x 15 cm with one plant per stand seems to be superior over the other three treatments in both the regions (west Benoue and South east Benoue).

3 - Farmers at Hama Koussou, Ngong and Poli were very much impressed with 80 x 15cm planting distance with one plant per stand. However, we could not contact farmers in the west Benoue due to breakdown and accident of the SAFGRAD-FSR vehicle towards the end of harvesting.

Crops Variety Testing Trials

Objective: (i) The objective of these trials is to comapare the performance of newly released crop varieties of maize, sorghum and groundnut in comparison to old or local varieties on farmers field in the sudano-sahelian zone of North Province of Cameroon.

(ii) Pass on the recommendation to the extension workers for adoption by farmers and (iii) Give feedback information to researchers (Breeders and Agronomists) at the stations.

During the year 1986-1987 several field trials on farmers field were carried out to test the performance of new varieties of maize, sorghum and groundnuts.

(a) Maize Variety trials - Farmer managed

Maize is becoming a popular crop among other cereals in North Proivnce of Cameroon, more especially in the southern part of the Province. Several maize varieties are now available to be cultivated in various part of the country. Taking into consideration the agro-climatic condtions of the country a single variety of genotype cannot be grown all over the Country. Breeders in the country in association with several national and international organisations and institutes have come-up with the varieties which are or may be suitable for various agro-climatic regions in the country based on durations of maturity, resistance to streak virus, yield and grain quality etc...

Method:

Varieties tested.

North east Benoue region

(a) SAFITA 2B

(b) Mixican 17E

(c) CMS 8501

West and south east Benoue

(a) TZPB - K81

(b) TZPB - SUAKOKO

(c) TZPB - SR

Seeds, raingauge, planting instruction for layout of trials and field lebels were distributed in the first week of April, 1986. Chief of sectors, Chief of zones and Monitors incharge of each trial were explained fully the methodology to carry-out the trials. Fields for the trials were selected during the months of May 1986 by Soil Scientist of SAFGRAD-FSR based at IRA Garoua in collaboration of SODECOTON. During the site selection, the Monitors incharge and Cheif of zones were further explained the objectives and methodology of the conduct of trials.

At each site an area of 0.25 ha was used to carry-out the trial. The fertilizer rates were used as per recommendation made by the maize Agronomist (90 kg N, 20 kg each of P_2O_5 and K_2O/ha). Also the planting distance was followed as per recommendation made (80 x20cm with one plant per stand giving a theoritical plant population of 62 500 plants/ha. As and when necessary reseeding was done within 7-10 days of first Planting. Weeding and other cultural operations were carried out as and when it was necessary. Most of the farmers followed the instructions in conduct of trials.

Results

(i) North east Benoue

The varieties which were tested in the north east Benoue regions were of short duration (90-100 days). The results of yield presented in Table 25 indicate that there were no significant difference in yield performance of these three varieties. However, at Pitoa farmers showed their preference for the new variety CMS 8501 because of its earlyness and resistant to streak virus. Results also indicate that yield performance of these varieties varies from sector to sector (Table 25).

Table 25:

YIELD PERFORMANCE OF MAIZE VARIETIES IN DIFFERENT SECTORS OF NORTH EAST BENOUE OF NORTH CAMEROON, 1986

SECTORS	Y I E L D (kg/ha)			
	MEXICAN 17E	SAFITIA 2B	CMS -8501	MEAN
Baikwa	4 004	3 019	3 212	3 412
Bibemi	3 759	2 203	2 300	2 754
Paderme	3 321	3 367	2 929	3 339
Pitoa	5 843	5 162	6 070	5 693
Mean	4 232	3 539	3 628	2 799

L.S.D. Varieties - N.S. L.S.D (Sector), 249

L.S.D. Variety x Sector N.S.

Table 26:

YIELD PERFORMANCE OF MAIZE VARIETIES IN DIFFERENT SECTORS OF NORTH PROVINCE OF CAMEROON, 1986

S.E.B				
Madingrin	5 541	5 240	5 375	5 385
N'dock	4 065	3 235	3 321	3 540
Sorombeo	3 794	4 238	4 277	4 103
Sud Vina	4 675	5 240	4 575	4 830
Tchollire	4 289	3 204	4 495	3 996
Touboro	4 534	4 678	4 490	4 567
Mean	4 483	4 306	4 422	4 404
	L.S.D. Variety: N.S., Sector: 642			
West Benoue				
Djalingo	3 570	3 032	3 378	3 186
Hama Koussou	2 917	1 928	2 926	2 590
Ngong	4 152	3 415	4 030	3 860
Poli	4 394	4 348	4 397	4 397
Mean	3 833	3 214	3 751	3 622
	L.S.D. Sector - N.S., Variety - N.S.			

The earlier work (Gwathney and Fabasso, 1983) carried out on variety trials indicate that Mexican 17E was better than the local. However, at taht time CMS 8051 was not released. At present with fewer number of test trials and one year's results, no difinite conclusion can be drawn.

(ii) West and south east Benoue regions

All the three varieties tested in these two regions are of about 120 days duration. Variety TZPB K-81 is already inuse in these two regions. The two new varieties were introduced this year based on their yield performance and resistant to streak virus. Rusults presented in Table 25 indicates that there were no significant yield differences obtained with these varieties. However, there is advantage of using TZPB-SR as it is streak resistant and in the long run it will be more benefi cial particularly when variety like TZPB-K81 suffers with streak virus disease. During the years 1979to 1985 varietal trials were carried-out with TZPB -K81 compared with other local and improved varieties (Gwathmey and Fabasso 1979-83) variety TZPB -K81 was foumd to be better. It is to be noted that TZPB-SR is the new release.

Comment and conclusion

(i) All the three varieties performed equally good in their yield level.

(ii) TZPB-SR has the advantage if it is used by the farmers because it is streak virus resistant which causes substantial loss in yield in certain years.

(iii)On one year data, no definite conclusion can be drawn.

(b) Sorghum Variety Trials on Farmers Field, 1986 (Researcher managed)

Method:

During the year 1986, six replicated trials with four varieties (S-34, ICSV-151 , CS-63 and local) were proposed to be conducted in collaboration with SODECOTON in the North Province of Cameroon. Out of six, only five were harvested successfully. The sixth trial was somehow got mixed-up at the time of harvesting and the protocol was lost by the monitor incharge of the experiment.

The trials at five locations were conducted in randomized complete block design with 5 replications and four varieties at each sites. Sites were selected before planting and materials, such as seeds, planting ropes, rain guage, plot lebels and measuring cups for Urea application were provided by SAFGRAD-FSR staff at the time of discussion of protocol with Chief of sector, Chief of zone and finally with the monitor.

At each location, trial was conducted on 0.25 ha field with the recommended dose of fertilizer application (60 kg N, 20 kg P_2O_5 and 15 kg K_2O/ha. Nitrogen was applied in two split doses of half at planting and half at one month after planting at the time of first weeding followed by ridging. Every effort was made to select the field for cereals which was cropped with cotton during the previous year. Yield data are presented in Table - 27

Results

Grain yield of sorghum obtained at different locations are given in Table 27. Results indicate that improved varieties outyielded local one at all the locations except Baikwa where yield difference between local and CS-63 was statistically non-significant. Variety ICSV-151 gave lower yield than local check at Baikwa.

Yield difference at Pitoa was statistically non significant. At Sorombeo, Poli, & Touboro the variety S-34 was found to be superior as compared to local as well as ICSV-151. However, yield difference between S-34 and CS-63 at Sorombeo, Poli and Touboro were non-significant.

overall mean yield of the five locations clearly indicate that variety S-34 and CS-63 are difinitely better than ICSV-151 and local. No significant difference in yield were obtained between S-34 and CS-63.

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Table 27:

PERFORMANCE OF VARIOUS SORGHUM VARIETIES OVER LOCATIONS IN NORTH PROVINCE, 1986

Varieties	Grain yield (kg/ha)						
	baikwa	Pitoa	Sorombeo	(Fignole) Poli	Touboro	Overal Mean	Increase over local variety (%)
S - 34	1 135	2 620	3 027	2 326	2 200	2 262	41.6
ICSV-151	590	2 237	2 114	2 007	1 867	1 763	10.4
CS-63	808	2 377	3 142	2 122	1 170	1 124	33.0
LOCAL	855	1 986	1 972	1 617	1 553	1 597	-
L.S.D. (0.05 p)	230	719	374	276	283	377	-
C.V. (%)	19.7	22.6	10.6	9.9	10.6	15.6	-

Earlier varietal testing carried-out in Extreme North Province under SAFGRAD (Gwathmey and Fobasso 1979 - 1983 indicate that varieties 38-3 and E35-1 were higher yielders as compared to local ones. Later (Johnson and Nzonig, 1984) the variety S-35 was found better than local in Extreme North Province.

The present increase in yield over local check was found to be 41.6, 10.4 and 33.0 with the variety S-35, ICSV-151 and CS-63 respectively (Table 27).

Comment and conclusion.

(1) Given the same inputs and management the two promising varieties S-34 and CS-63 are difintely better than the present local or even ICSV-151 in their yield performance.

(2) Planting of S-34 and CS-63 had to be delayed (between 5-20 July) in order to avoid the decolouration of grains and grain molds.

(3) Plant populations had to be maintained at least 50 000 plants/ha (even in the experimental field the theoritical plant population of 62 500 could not be maintained). So every efforts should be made to have optimum plant population so as to harvest good yield.

(4) Many farmers have made comment on the variety S-34 saying that it is too sugary and children used to pull-out the plant and chew it as sugarcane. Also the birds damage of this variety is higher as compared to local one (bird damage can be avoided by adjusting the time of planting so that this variety should mature at the same time when other local varieties are mature).

(c) Groundnut Variety Trials, 1986 **(Farmers Managed)**

Groundnut (*Arachis hypogaea*) is becoming one of the most important cash crop after cotton in the North Province of Cameroon. In Northern part of Cameroon, the production of groundnuts is second in importance after sorghum and millets and is of greater importance than cotton. (USDA Resource inventary of North Cameroon, 1978).

Before my arrival in January, 1986, two potential areas for groundnut variety testing were selected by the groundnut breeder in consultation with SODECOTON. These two areas were west Benoue and south east Benoue. In west Benoue, 10 sites were selected, 5 in each of Djalingo and Ngong sectors and in south east Benoue 12 sites were selected, 3 in each of Tchollire N'dock, Sorombeo and Touboro sectors;

Method:

Varieties tested:

(i) West Benoue

a- 28-206 as check variety

b- M513-77-I

c- K 1 441-77

(ii) South east Benoue

a- 28-206 as check variety

b- K 1 137-40-78

c- K 1 332-78

Seed, rain guage, planting rope, instructions for all the operations, field lebels etc··· were distributed in the first week of April, 1986. Chief of Sectors, Chief of zones and Monitors incharge of the experiments were explained fully on how to carry-out the trials. Later in the month of May Soil Scientist and technician of SAFGRAD-FSR along with Mr. ASFOM Paul, incharge of fields experiments of SODECOTON visited the sites and explained further the methodology to carry-out the trials. With several vistis by Soil Scientiest and technician of SAFGRAD-FSR it was possible to harvest all the 22 trials laid out on farmers field.

Field area for each trial: At each location 0.25 ha (50 x 50m) plot was divided into three equal parts to plant the three varieties.

Planting distance: Row to row distance was 40 cm with plant to plant distance 20cm (theoritically it gives the plant population of 125000/ha).

Fertilizer: Single superphosphate at the rate of 100 kg (18 kg P_2O_5) per hectare was applied before planting.

Reseeding and gap filling: Whenever and wherever it was necessary, the reseeding and gap filling was done after 7 days of planting.

Results:

(i) West Benoue region: Ten on-farm trials in two sectors with three varieties of groundnuts were conducted during 1986 cropping season in west Benoue region. Results on pod yield presented in Table 28 indicate that the two newly introduced varieties (introduction from Nigeria) did not differ significantly in comparison to the variety 28-206. However, in Ngong sector, variety K 1 441 - 77 gave 303 kg/ha higher that 28-206. Variety K 1 441 is relatively early maturing as compared to 20-206 and in year when rainfall stops early in the season this variety may still be suitable for the west Benoue region.

Looking at the data of two sectors, the overall performance of groundnut in Ngong sector was better than Djalingo. An overall increase in mean yield over varieties in Ngong sector was 546 kg/ha as compared to Djalingo. Data presented in Table 28 on the yield of sheeled nuts behaves in the same way as of pod yields.

Shelling percentage presented in Table 28 indicate that variety K 1 441-77 has slightly higher shelling percentage as compared to other two varieties. However overall mean shelling percentage in Djalingo is lower as compared to Ngong sector.

Data presented on mean plant density in Table 28 for the two sectors in west Benoue indicate no significant difference. Although, none of the trials have achieved 100% recommended plant density but have been able to achieve up to 80% of the theoritical plant population which is quite encouraging.

Rable 28.

PODs YIELD, SHEELED NUTS, SHELLING PERCENTAGE AND PLANT POPULATION OF DIFFERENT VARIETIES OF GROUNDNUTS IN TWO SECTORS OF WEST BENOUE, 1986.

Observations	Sector	Varieties of groundnuts			
		28-206	M513-77-1	K 1 441-77	Mean
Pods Yield (kg/ha)	Djalingo	2833	2396	2636	2628
	Ngong	3139	2941	3442	3174
Mean		2986	2668	3039	2898
L.S.D. (0.05 p) Sector -N.S. Variety - N.S.					
Shelled nuts (kg/ha)	Djalingo	1888	1666	1897	1797
	Ngong	2244	2050	2468	2254
Mean		2066	1828	2182	2025
L.S.D. (0.05 p), Sector- 310., Variety-N.S.					
Shelling %	Djalongo	66.7	69.5	72.1	69.7
	Ngong	71.5	69.7	71.7	71.0
Mean		69.1	69.6	71.9	70.9
Mean Plant density/ha	Djalingo	99611	93646	106625	99961
	Ngong	110576	93604	95236	99806
Mean		105094	93625	100931	99883
L.S.D. (0.05 p), Sector - N.S., Variety-N.S.					

15, 16, 17, 18.

(ii) South east Benoue:

Twelve trials in four differnt sectors of south east Benoue with three varieties were carried-out on the farmers field during 1986 cropping season. The check variety was the same as of west Benoue (28-206) which was compared with the two new introduction (K 1 137-40-78 and K 1 332-78). These two new varieties were introduced from Nigeria which were grown in the Kano area of Northern Nigeria.

Data on pod yields presented in Table 29 indicate that there were no significant yield differences amongst the varieties. The pod yields of variety 28-206 vary from 2 656 kg/ha to 3 028 kg/ha with a mean value of 2 908 kg/ha. The respective values for K 1 137-40-78 and K 1 332-78 were 2 240 to 3 160 kg/ha with a mean value of 2 716 kg/ha and 2 631 to 3 417 kg/ha with mean value of 3 029 kg/ha respectively.

Results on shelled nuts presented in Table 29 gives the same yield trend as of pod yields; however, the shelling percentage presented in Table 29 indicate that variety K 1 332-78 is supperior to other varieties with a mean shelling percentage of 77.6.

Plant density in Table 29 indicate that no farmer has achieved the recommended theoritical plant population of 125 000/ha. However, the mean value indicate an acheivement of up to 80% plant population.

Comment and conclusion

(1) Yield performance of groundnuts in general in both the regions are quite encouraging. Yield up to 3 517 kg/ha has been achieved.

(2) Variety K 1 441-77 seem to be promising in west Benoue due to its earlyness in maturity and also little higher shelling percentage.

(3) Variety K 1 332-78 for south east Benoue has better prospect based on its high shelling percentage. However, based on one year's results no definite conclusion can be drawn.

Table 29:

PODs YIELD, SHELLED NUTS, SHELLING PERCENTAGE AND PLANT POPULATION OF DIFFERENT VARIETIES OF GROUNDNUTS IN FOUR SECTORS OF SOUTH EAST BENOUE, 1986

Observations	Sector	Varieties of Groundnuts			
		28-206	K 1137-40-78	K 1 332-78	Mean
Pods yields (kg/ha)	N'dock	2988	2392	3013	2797
	Sorombeo	2656	2240	2631	2509
	Tchollire	3028	3160	3056	3081
	Touboro	2960	3072	3417	3150
Mean		2908	2716	3029	2884
L.S.D (0.05 p), Variety - N.S., Sector N.S.					
Shelled nuts (kg/ha)	N'dock	2196	1670	2240	2035
	Sorombeo	1974	1566	1968	1836
	Tchollire	2307	2429	2395	2377
	Touboro	2153	2189	2828	2390
Mean		2157	1964	2558	2160
L.S.D. (0.05 p), Variety, N.S., Sector., N.S.					
Shelling %	N'dock	73.5	69.8	74.3	72.5
	Sorombeo	74.3	69.3	74.8	72.8
	Tchollire	76.2	76.9	78.4	77.2
	Touboro	72.7	71.3	82.7	75.6
Mean		74.2	71.8	77.6	74.5
Mean Plant density/ha	N'dock	111713	107954	108861	109509
	Sorombeo	106440	107593	102343	105458
	Tchollire	89815	84583	83037	85812
	Touboro	92750	97417	97704	95957
Mean		100179	99387	99986	99184
L.S.D. (0.05 p), Variety, N.S., Sector - N.S.					

19, 70, 71, 22,

SOIL FERTILITY STATUS OF SOIL SAMPLES COLLECTED FROM EXPERIMENTAL SITES IN NORTH PROVINCE OF CAMEROON, (1986)

During the cropping season of 1986, soil samples from the experimental plots of farmers fields were collected up to a depth of 0-20 cm in order to find out the initial nutrients status of the soil. As far as possible samples were collected before the application of fertilizer and planting of crop. In some cases soil samples were collected towards the end of cropping season when crop was almost mature to harvest.

In all, 94 samples from the 94 trials were collected. Where two experiments were laid out in the same field side by side, such samples were bulked together to reduce the number of samples. In the end 75 samples were analysed for pH, organic carbon, total nitrogen, exchangeable Ca, Mg, K, Na and available phosphorus.

Since there were no facilites available for chemical analysis of soil either in Garoua or in Maroua, the Soil Scientist got these samples analysed out side of Cameroon.

Methodology: Samples collected from the field were air dried in shade and powdered using wooden pestle and mortar. Powdered samples were passed through 0.2 mm sieve and stored in fresh plastic bags for further analysis.

Analytical Method: Soil pH was determined in the 1 : 2 · 5 soil water solution using electronic pH meter. Organic carbon was determined by wet digestion method using the procedure described by Walkley and Black. Total nitrogen was determined by kjeldahl digestion method and later on distillation was done using semi-micro-kjeldahl apparatus.

Exchangeable cations were determined in the leachate of 1 N neutral ammonium acetate extract. Ca^{++} and Mg^{++} were determined by atomic absorption spectrophotometer and

the K^+ and Na^+ by flame photometer. Summations of all the exchangeable Cations were treated as cations exchange capacity.

Available phosphorus was determined following the method of Bray-1 and the percent transmission was read on spectronic-20 colorimeter. Analytical results have been summarized in three different Tables for west Benoue, north east Benoue and south east Benoue regions of SODECOTON.

Results and discussion: West Benoue Results presented in Table 30 for different sectors of west Benoue indicate that soils are almost normal in pH but low in organic carbon, total nitrogen and CEC. Potassium content in Djalingo and Ngong sectors is quite low. At Poli sector it is almost at border line. However, the mean value of exchangeable K in Hama Koussou sector appears to be on the higher side.

In general, the fertility level in Djalingo and Ngong is much lower than Hama Koussou and Poli sectors of west Benoue region (Table 30). Exchangeable Mg in Djalingo and Ngong sectors is also seems to be low and if proper management practices are not followed, the soils will become deficient in Mg. There is need that soils in Djalingo and Ngong sectors must be managed properly in terms of Mg and K besides N. On the other hand soils in Poli and Hama Kousson needs better management practices for phosphorus and N among major nutrients.

North east Benoue: Most of the soils in this region are normal in soil reaction but low in organic carbon and total nitrogen (Table 31). Exchangeable Ca^{++} and Mg^{++} are quite high except in the sector of Baikwa where Mg seems to be low. Exchangeable K^+ in Bibemi sector is very low and it needs judicious use of potassic fertilizer. Base saturation is quite high in most of the soils in this region. Except in Baikwa sector, available P seems to be on lower sides in other three sectors of the north east Benoue region.

South east Benoue: Soil analysis data presented in Table 32 indicate that soils in this region are quite normal in soil pH, low in organic carbon and total nitrogen content. It appears that amount of exchangeable Ca, Mg and K are low as compared to north east Benoue region. Soil in N'dock, Sorombeo, Madingrin and Touboro seem to be low in potassium. Soils in Touboro sector needs special attention in terms of K and P application. From the data of south east Benoue region it appears that there is losses of cations either through leaching or through surface runoff.

Comments and conclusion:

(1) Soil analysis data indicates that most of the soils in Northern Province are quite normal in soil pH, low in organic matter and total N.

(2) Most of the soils in the Province are becoming low in potassium and there will be need to apply sufficient potassic fertilizer if continuous and intensive cropping system is to be followed.

(3) Soils in most of the sectors in the Province needs proper and balanced application of phosphatic fertilizer. There are exceptions where available P content of the soils is quite sufficient.

Table 30:

MEAN SOIL TEST VALUE OF DIFFERENT SECTORS OF NORTH PROVINCE OF CAMEROON
(BASED ON THE SAMPLES COLLECTED FROM EXPERIMENTAL FIELD IN 1986)

Sector		Soil Test Value									
		pH (Water)	O.C. (%)	Total N (%)	C/N Ratio	Exchangeablr Cations (Meg./100g)				C.E.C. (Meg/100g)	Available p (ppm)
						Ca	Mg	K	Na		
West Benoue											
Djalingo	Range	5.8 to 6.7	0.5 to 0.6	0.05 to 0.7	8.3 to 11.4	0.50 to 1.22	0.23 to 0.39	0.06 to 0.18	0.01 to 0.12	0.83 to 1.76	7.21 to 27.16
	Mean	6.3	0.6	0.06	-	0.98	0.34	0.10	0.4	1.46	14.60
Hama Koussou	Range	6.2 to 6.9	0.50 to 1.0	0.05 to 0.10	10.0	1.06 to 31.19	0.32 to 13.16	0.08 to 1.06	0.02 to 0.29	1.56 to 45.7	2.54 to 9.85
	Mean	6.5	0.8	0.08	-	8.92	3.69	0.37	0.09	6.21	6.01
Ngong	Range	5.9 to 6.7	0.6 to 0.8	0.05 to 0.08	10.0 to 11.7	0.65 to 1.75	0.23 to 0.91	0.05 to 0.27	0.01 to 0.07	0.94 to 2.80	4.85 to 26.58
	Mean	6.3	0.7	0.06	-	1.31	0.47	0.13	0.02	1.94	9.40
Poli	Range	6.0 to 7.9	0.5 to 0.8	0.05 to 0.08	10.0 to 14.00	1.31 to 8.17	0.47 to 8.30	0.10 to 0.22	0.02 to 0.08	1.74 to 16.73	3.68 to 7.27
	Mean	6.5	0.7	0.06	-	3.13	2.16	0.16	0.04	5.44	6.11

Table 31:

MEAN SOIL TEST VALUE OF DIFFERENT SECTORS OF NORTH PROVINCE OF CAMEROON (BASED ON THE SAMPLES COLLECTED FROM EXPERIMENTAL FIELD IN 1986)

Sector		Soil Test Value									
		pH (water)	O.C. (%)	Total-N (%)	C/N Ratio	Exchangeable Cations (Meg./100g)				C.E.C (Meg/100g)	Available P (ppm)
						Ca	Mg	K	Na		
North East Benoue											
Baikwa	Range	6.4 to 6.6	0.8 to 0.9	0.08 to 0.09	10.0	2.25 to 4.42	0.07 to 0.73	0.10 to 0.30	0.03 to 0.07	3.15 to 4.83	3.35 to 43.13
	Mean	6.5	0.8	0.08	-	3.34	0.40	0.20	0.05	3.99	32.24
Bibemi	Range	5.9 to 6.7	0.5 to 0.7	0.05 to 0.07	10.0	1.46 to 9.36	0.37 to 4.32	0.04 to 0.14	0.02 to 0.33	1.99 to 14.05	3.98 to 6.76
	Mean	6.3	0.6	0.06	-	5.41	2.34	0.09	0.17	8.02	5.37
Paderme	Range	6.3 to 6.8	0.9 to 1.3	0.09 to 0.16	8.1 to 10	16.21 to 27.94	6.13 to 6.38	0.31 to 0.36	0.21 to 0.77	23.42 to 34.89	6.39 to 6.56
	Mean	6.5	1.1	0.12	-	22.0	6.25	0.33	0.49	29.15	6.50
Pitoa	Range	6.2 to 6.5	0.8 to 0.9	0.07 to 0.08	10.0 to 11.0	6.38 to 14.97	2.08 to 3.29	0.31 to 0.32	0.10 to 0.16	8.82 to 18.74	6.27 to 6.76
	Mean	6.3	0.8	0.07	-	10.53	2.70	0.31	0.13	13.78	6.52

Table 32:

MEAN SOIL TEST VALUE OF DIFFERENT SECTORS OF NORTH PROVINCE OF CAMEROON BASED ON THE SAMPLED COLLECTED FROM EXPERIMENTAL FIELD IN 1986)

Sectors		Soil Test Value									
		pH (water)	O.C. (%)	Total N (%)	C/N Ratio	(Exchangeable Cations (meg. 100g) Ca	Mg	K	Na	C.E.C. (Meg/100g)	Available p (ppm)
South east Benoue											
Madingrin	Range	6.0 to 6.3	0.6 to 0.8	0.06 to 0.08	8.7 to 10.0	1.56 to 2.41	0.50 to 0.74	0.10 to 0.28	0.03 to 0.08	2.24 to 3.47	6.64 to 41.47
	Mean	6.2	0.7	0.07	-	1.99	0.67	0.19	0.04	2.89	15.73
N'dock	Range	6.0 to 6.5	0.2 to 1.3	0.08 to 1.11	2.2 to 11.8	1.25 to 4.93	0.39 to 1.28	0.08 to 0.30	0.02 to 0.08	1.74 to 6.65	5.55 to 37.02
	Mean	6.2	0.8	0.09	-	2.53	0.84	0.17	0.05	3.61	17.50
Sorombeo	Range	5.4 to 6.6	0.6 to 1.0	0.06 to 0.10	9.1 to 10.0	1.35 to 2.12	0.41 to 0.87	0.11 to 0.23	0.03 to 0.08	1.94 to 3.22	4.85 to 18.10
	Mean	6.2	0.7	0.07	-	1.60	0.55	0.16	0.05	2.36	10.53
Sud Vina	Range	6.1 to 6.5	0.7 to 0.1	0.07 to 0.10	10.0 to 11.0	1.17 to 4.30	0.37 to 1.46	0.16 to 1.12	0.03 to 0.04	1.73 to 6.92	5.95 to 13.53
	Mean	6.3	0.9	0.09	-	2.74	0.92	0.64	0.04	4.32	9.74
Tchollire	Range	5.8 to 7.0	0.5 to 1.0	0.05 to 0.10	8.7 to 11.1	0.10 to 5.36	0.27 to 1.05	0.05 to 0.77	0.01 to 1.01	0.08 to 7.24	5.24 to 24.77
	Mean	6.4	0.8	0.08	-	1.62	0.52	0.22	0.15	0.57	11.15
Touboro 6.7	Range	5.9 to 6.7	0.5 to 1.0	0.05 to 0.09	10.0 to 12.5	0.72 to 2.50	0.32 to 2.44	0.08 to 0.20	0.01 to 0.05	1.24 to 3.77	4.52 to 8.77
	Mean	6.3	0.8	0.08	-	1.43	0.77	0.11	0.03	2.34	6.84

SAFGRAD - FSR, IRA, GAROUA

Summary of the 1986 Field Trials and Soil Analysis

During 1986 cropping season, 94 field trials were proposed yo be conducted on the farmers field in collaboration with SODECOTON in the Northern Province of Cameroon. Out of 94 trials, 4 trials were managed exclusively by the SAFGRAD-FSR staff with Soil Scientist as the Principal investigator. The remaining 90 trials were laidout on the farmers field or where farmers fields were not available, the trials were laidout on the fields hired by SODECOTON. Only 4 of such experiments were laidout on the hired fields.

Out of 94 trials, 83 trials were harvested successfully giving a sucess percentage of 88.3. Few trials were not harvested successfully were either washed away during heavy rain or were waterlogged. Two trials were not laidout at all since very begining due to non-availability of suitable land but this information was given to Soil Scientist of SAFGRAD-FSR, IRA during the second visit when it was already late to plant. Results obtained from the field trials during the first year are summarized below:

1. Fertilizer and Manure Trials.

Trials were conducted on two different types of soils. Soils at Badjouma was a heavy soil with higher fertility status and at Ngong it is sandy soil with low inherent fertility status. Yield performance of late sown maize was quite low at Ngong as compared to Badjouma. However, the differences were the same at both the places. Application of 100 kg N/ha gave almost similar yield as of 50 kg N + 5 tons on animal manure/ha. The experiment will continue on the same site to obtain a definite conclusion on the basis of two or three years data. Also soil analysis will be made in order to findout the changes in soil nutrients status under different treatments.

2. Soil moisture conservation study on maize

Trials which were managed entirely by the SAFGRAD soil scientist at two different locations on two different types of soils have been discussed fully in the text.

Results indicate that tied ridging at 2m interval is beneficial in the sandy soils with poor water holding capacity and low in inherent fertility status. Soils which are heavy (clay loam) did not give any beneficial results of tied ridging rather there were water logging and crop (maize) suffered due to lack of root aeration.

On farmers field ridging after one month of planting gave 37.3% higher maize yield than flat planting and no ridging. On an average,tied ridging did not give any increase in maize yield over simple ridging but increase in yield over flat planting and no ridging was about 14.3%.

3. Soil Moisture conservation study on sorghum production

Trials carried-out with sorghum did not indicate any beneficial effect of ridging and tied ridging in the North Province of Cameroon. However, at Pitoa, ridging gave higher yield of sorghum compared with flat and tied ridging. The reason could be (i) sorghum is quite tolerant to moisture tress compared to maize. (ii) Area where these experiments were carried out received quite sufficient rainfall during the crop period. (iii) The crop variety of sorghum used (S-34) is a short duration.

4. Maize density/plant population trials on farmers field

During the cropping season of 1986, twelve trials were harvested successfully. It is interesting to note that no farmer have achieved the theoretically recommended plant population in field trials. However, many farmers achieved the plant population up to 80% of the recommended one. In west Benoue, the mean yield of maize was significantly higher when planting was done at 80 x 15cm distance with one plant per stand as compared to other three treatments.

In south east Benoue, grain yield of maize with the planting distance of 80 x 15cm with one plant per stand was superior than other treatments but statistically non-significant.

5. Maize variety trials on farmers fields

North east Benoue; The varieties tested in this regions were of short duration (90-100 days) or short cycle. However, there were no significant yield differences obtained amongst three varieties vis. Mexican 17E, Safita 2B and CMS-8501 but farmers showed their preference towards CMS-8501 due to its early maturity and streak resistant.

West and south east Benoue: Yield difference in three varieties tested (TZPB-K81, TZPB-SUAKOKO and TZPB-SR) were non significant in both the regions of North Province of Cameroon. However, there is advantage of using TZPB-SR because it is resistant to streak virus disease which causes substantial loss in yield in certain years.

6. Sorghum variety Trials

Five trials with four varieties (S-34, ICSV-151, CS-63 and local) were carried-out in randomiwed complete block design with 5 replications in different sectors of North Province of Cameroon during 1986 cropping season. The overall mean yield indicates that variety S-34 and CS-63 gave almost similar yield i.e. there were no significant yield difference between these two varieties. However, increase in yield over local variety with S-34 and CS-63 were 41.6 and 33.0% respectively.

7. Groundnut variety trials on farmers field:

West Benoue: The three varieties of groundnuts (28-206, K 1 441-77 and M 513-77- tested on ten sites in the two sectors of west Benoue regions did not give any significant yield differences. However, variety K 1 441-77 in Ngong sector gave 303 kg higher yield than variety 28-206 and also the shelling percentage of K 1 441-77 was higher as compared to other two varieties. Although statistically these varieties did not differ in their yield performance but the variety K 1 441-77 has an advantage that it matures earlier than 28-206 and will be useful in the years and areas where rainfall duration is short.

South east Benoue Twelve trials with three varieties (28-206, K 1 137-40-78) were carried out in 4 different sectors of south east Benoue. There were no significant yield differences amongst these three varieties tested in the present series of trials. However, based on shelling percentage, variety K 1 332-78 seems to have better future in this region as compared to other two varieties.

8. Soil fertility status of soils

Chemical analysis data presented in tables 30, 31 & 32 clearly indicates that most of the soils are almost normal in soil reaction (pH) but slightly on acidic side. Most of the soils are low in organic carbon and total nitrogen content also majority of the soils indicates a declining trend of exchangeable K (in turn available K) with few exceptions. If continuous and intensive cropping in the area is to be followed then there is great need to apply sufficient amount of K fertilizer or else the crop residues should be returned in one or the other form back to the field.

Available P content in most of the sectors is in low to medium range with few exception where available P content was quite high. In general, a proper and balanced scheduling of P ferilization is necessary based on the demand of crop and cropping intensity.

CONCLUSION

In conclusion, the SAFGRAD/Cameroon FSR programme has as its specific objectives (i) to conduct socio-economic studies to identify agricultural production constraints (ii) to test the performance of improved varieties of sorghum , maize and groundnuts under farmers' conditions and (iii) to test soil moisture conservation techniques as well as animal manure at farm level.

Since 1986 was the first year, no conclusions can be drawn. The socioeconomic studies, however suggest that the existing farming systems consist of cotton-based cropping system for cotton farmers and sorghum/groundnuts based farming system for non-cotton farmers. The average farm family has 9 to 10 persons with about 5.46 man-units for farm labour. The major production constraints include poor soils and declining soil fertility,drought and/or prolonged dry spells at the time of planting, moisture stress and inavailability of farm tools.

The preliminary results from the agronomic on-farm trials suggest that (i) 100 kg N/ha may give the same crop yields as 50 kg N/ha supplemented by 5 tons of animal manure per ha. (ii) That with sandy soils, tied ridging at 2m interval after one month of planting may give good yields. (iii) That the planting distance of 80 x 15 cm with one plant per stand for maize may give the best crop yields. (iv) That the groundnuts varieties of K 1 441-77 and K 1 332-78 are promising for west Benoue and south east Benoue regions respectively, and (v) That the improved sorghum variety S-34 being a short cycle variety of 90 days has good yield potentials but needs planting dates to be adjusted to avoid decolouration of grain and grain molds.

Sofar the peliminary results of the first year have gone a long way in giving insight on future development of the SAFGRAD/FSRactivities in North Cameroon.

1986

SAFGRAD/CAMEROON FSR PROGRAMME ANNUAL REPORT - 1986 (DRAFT)

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