REPUBLIC OF CAMEROON
MINISTRY OF SCIENTIFIC AND
TECHNICAL RESEARCH
(MRST)
INSTITUTE OF AGRICULTURAL RESEARCH
(IRA)

National Cereals Research and Extension Project (NCRE)

Annual Report

1992

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

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ACKNOWLEDGEMENTS

The success of the National Cereals Research and Extension (**NCRE**) Project can be attributed to the contributions of many persons and groups.

The IITA/NCRE technical assistance team is very grateful to the Government of the Republic of Cameroon for its total support of the project activities through its Ministry of Technical and Scientific Research (**MRST**) and the Institute of Agricultural Research (**IRA**).

The team is particularly indebted to the Minister of MRST and Director of IRA, Dr. Jacob Ayuk-Takem, for his valuable professional guidance, able leadership, commitment constant understanding, patience and intellectual stimulation. His counsel and suggestions have been invaluable.

Equally important has been the support received from all IRA Chiefs of Centers, Stations and Sub-stations and from the scientific administrative and support staff. In particular we would like to acknowledge the important contribution of the national counterparts and technicians who have provided invaluable advice to the technical assistants. Some of the national counterparts and technicians have already taken over the role of the technical assistants. We expect that all of them will carry on the work started by this project. Without their cooperation and receptiveness this project could not have been a success.

The collaborative effort of ICRISAT with regard to the project's sorghum and millet unit is greatly appreciated. The assistance received from CIMMYT and IRRI is also greatly appreciated. We would also like to acknowledge SAFGRAD, MIDEVIV, MIDENO, SODECOTON, WARDA, SODERIM, UNVDA, SEMRY, CIRAD and CORAF the staff of the Karewa Experimental Farm and the staff of the University Center Dschang.

We are thankful to IITA for its administrative and technical support and for its encouragement.

We would also like to express our deepest gratitude to the Government of the United States of America through its Agency for International Development (**USAID**) whose financial assistance has made this project possible. We cannot talk about the NCRE project and USAID-Cameroon without mentioning the dedication and support of the Mission Director and to the entire USAID-Cameroon Mission. We are deeply indebted to all of them.

Perhaps the greatest contributions to the success of the NCRE Project have come from the farmers of Cameroon. Without their cooperation and receptiveness, this project could not have been successful. To them we say thank you.

PREFACE

During 1992, NCRE and the IRA Cereals and Farming Systems programs were subjected to many uncertainties. Political unrest in the country reduced to the point where life in North West and West provinces returned to normal. The NCRE work in northern Cameroon (Garoua and Maroua) were not affected. The most seriously affected was Bambui where scientists were stopped for several weeks. On-station work in Bambui, Ekona and Nkolbisson was halted but on-farm work continued. On-farm research around these locations was generally accomplished 80% of that planned during 1992. Researchers in Ekona and Nkolbisson were able to continue working in IRA offices even though other research units were stopped. It should be noted that after the reporting period of this report (1992) the Nkolbisson and Ekona researchers were also forced to leave their offices. In all cases researchers and counterparts simply moved daily operations to their homes and farmer's fields.

This report of the National Cereals Research and Extension Project (NCRE) represents a summary of project activities for the calendar year of 1992. It is written to fulfill USAID contract requirements and as such contains brief summaries of research and extension activities conducted under NCRE direction. It is not meant to provide a complete technical reporting of research activities. Complete reports of research activities are prepared by each unit and published separately. Only a few research activities are reported in detail in the Research Findings sections here. Those activities which were still underway or which did not produce results are reported only in the accomplishments table of this report. When an activity is completed it is reported in detail in the annual report.

This report is the final report in a series of reports prepared by NCRE during each year. The Plan of Work prepared during the first two months of each year describes work planned for a calendar year. A Semi-Annual Progress Report prepared in August of each year gives a brief progress report on work planned. The Annual Report for a calendar year presents accomplishments and significant results for the same calendar year. In all reports a table lists Operations, Objectives and Activities for each unit. These items define the research program of each research unit and provide a capsule view of activities. Because the agricultural calendar in Cameroon is varied there are always some uncompleted research activities remaining at the end of a calendar year when the Annual Report is written. Results from these activities are reported in the following Annual Report.

This report is testimony to the dedicated researchers of IRA who sometimes risked the ire of strikers to carry on their work. Without their dedicated support, NCRE would have been stopped.

EXECUTIVE SUMMARY

Administration

During 1992, the NCRE Project operated under difficult conditions of political unrest and workers strikes. In spite of these problems the majority of planned work was completed. The chief of party visited researchers in all locations plus degree program students in the USA. Three long term staff left the project in 1992. The last long term trainee left Cameroon for studies in the USA. One MSc trainee returned and a PhD trainee completed her in-country research.

Highland Maize Breeding

The goal of the Highland Maize Breeding Unit is to further develop a comprehensive breeding program that will continuously provide seed for new varieties to seed agencies. Maize sown in 1992 at 5 locations in the three provinces included open pollinated and hybrid trials, nurseries for population improvement and inbred lines development, as well as isolated plots of breeder's seed. Synthetic-4, Kasai-SR, ATP-90 for Midaltitude zones, and Improved to be promising and immediately recommendable for release. 88069 x 87036, 88094 x M131, 90323 x 88069, M131 x 89274 and 89258 x 89182 single cross hybrids can also be recommended, for production. The newly constructed structures for streak screening are not yet being used because of budgetary and technical problems.

Lowland Maize Breeding

The lowland maize breeding program performed a total of 116 trials in the savanna zone and 96 trials in the forest zone during 1992. Over 15 ha were dedicated to seed multiplication and variety maintenance. In the forest zone acid soils form the major constraint to increased maize production. In the savanna zone *striga* is the main threat. Varieties are being developed and tested to overcome both of these constraints and to serve future commercial markets for maize in Cameroon.

Rice Breeding

Rice research activities across the nation were mainly focused on the development of improved varieties in the various ecologies with the characteristic long and transent grains. High and stable yields remain a regional priority. The various stresses encountered were drought, low temperatures and diseases (blast, leaf scold, sheath rot, glum discoloration). Improved germplasm from INGER - Africa and WARDA will be tested in 1993 for these stresses. ITA 300 is gradually replacing BKN 7033-3-3-2-2-3 in Lagdo.

Cereals Agronomy

During 1992, the researchers of this Unit have been involved in several activities: development and management of the IITA-IRA/NCRE Striga Research Farm (10 ha farm located at Garoua - Bokle), organization of a regional COMBS/IITA Workshop, preparation

of 3 technical papers and 2 compendiums of agronomic recommendations for maize and sorghum. The Unit also organized 5 training field days for researchers, extension agents and farmers on conservation farming practices and legume - based technologies. It provided technical assistance to several agricultural agencies and farmers. Ing. A. Youri joined our research team as national counterpart. A set of 21 experiments were conducted on station and on-farm in the subhumid lowland savanna of North Cameroon. Research indicated that the system of interplanted fallow used in our trials can be productive in farmers' fields. Research on multipurpose legume species showed the potential of 4 legume species for improving soil productivity and weed suppression. Studies on integrated Striga management confirmed the value of Crotalaria, Cassia, cowpea, cotton as trap crops as well as intercropping, the use of cow manure and cotton seed cake as practical means to alleviate Striga damage on maize and sorghum in the subhumid lowland savanna.

Sorghum

The 1992 sorghum research program has the primary objective of evaluating advanced breeding material and generating segregating materials from local and exotic germplasm. Particular emphasis was placed on striga resistant varieties, development, testing, improving local cultivars using the following criteria: height, cycle, grain color, panicle shape and size, resistance to diseases.

Bambui TLU

All the activities proposed for 1992 cropping season were started at the beginning of the season. However only about 75% of the activities were successfully completed by the end of the year. Intensification of workers strikes in Bambui between July and September prevented harvest data collection from about 15% of the on-farm maize variety trial sites. Similar strike in collaborating institutions like University Center Dschang and IRA Ekona put a halt to all soil and plant analyses required to complete reports on some activities.

In spite of these difficulties Bambui TLU was able to conclude on-farm evaluation of the second generation of maize varieties specially bred for both mid and high altitude zones of the Western Highlands. Synthetic 4 and ATP (Acid Tolerant Population) are now recommended along with Kasai and COCA in the mid-altitude region, while variety HAP appears to be viable alternative maize variety for farmers in the high altitude region who can afford moderate amounts of fertilizer (200 kg/ha 20-10-10 compound).

Three hundred minikits were distributed to farmers during the season. Feedback was received from 130 VEWs. The low return was due to the socio-political situation in the region. In 1993 more adoption plots will be established. A Rapid Rural Appraisal Survey of Ngie in Momo Division in the North West Province revealed three principal constraints to adoption of Agroforestry technology viz:-

1. Land tenure system which forbids planting of permanent crops or trees.
2. Uncontrolled dry season grazing whereby cattle and small ruminants roam and destroy planted trees especially Calliandra and Leucaena.
3. Uncontrolled bush fires.

A similar exercise is planned for Ndonga Matung Division in 1993.

Results from on-station field trials did not indicate any direct benefit by maize from N fixed by intercropped food legumes beans and soybeans. The implication of these results on the technology of simultaneous legume fallows should be investigated. Preliminary agronomic trials with hybrid maize showed that a planting density of about 50,000 per plants hectare and 80 kg N/ha are optimum for hybrid maize in the Western Highlands.

Ekona TLU

In spite of 1992 being a difficult year because of strikes by workers, Ekona TLU has been able to carry out most of its planned activities though we would have liked to do better. Varietal evaluations continue to show the superiority of NCRE improved varieties of cassava and maize. For the first time, results from yields of cocoyam, *Xanthosoma* selections, at farm level and tissue culture-derived cassava in an on-station field trial are reported where it yielded 28% higher than its genetically improved equivalent.

Four year data show that *Gliricidia and Leucaena* alleys sustained maize yield while 40-80 Kg N/ha did not. Observations from cocoyams in alley showed a reduction of *pythium* rot in shaded cocoyam: an information which needs further confirmation since chemical treatment proved ineffective in *pythium* control.

The 1992 food crop prices were lower than those of the last three years. IRA cassava had better retention and diffusion rates than maize. We also collaborated with ROTREP and GATSBY Charitable Foundation of Great Britain. Under ROTREP, we (i) supervised a student thesis on the factors affecting cocoyam production in Fako Division and (ii) carried out a Supply and Demand analysis of root and tuber crops in Southwest markets. The gari processing study of GATSBY showed that the semi-improved system of processing involving the motorized grater was better than the local involving hand grating.

Maroua TLU

Maroua TLU made an effort to streamline on-farm testing activities, including analysis of present methodology and existing methodology to improve farmer participation. Testing of maize, sorghum, and peanut varieties, sorghum and seed treatment, sorghum/cowpea association and cowpea storage technology all produced useful results for extension. For example, TLU is making a strong case for large scale production of seeds of the following varieties: CMS 8704 and DMR-ESR-Y for maize in compound cropping; CS 141 as a substitute for S35 sorghum for high stalk production. Solar heat treatment for cowpea storage has been brought to the point of potential economic impact. A major accomplishment has been demonstration of stabilization of sorghum and cowpea yields through intercropping on-farm for the third straight year.

On-station technology generation in sorghum agronomy was tightly linked to the needs of the TLU. Stabilization of sorghum production through striga control and soil moisture and improved fallow and alley cropping technology is ready for testing in 1993. Diagnostic activities were completed to help guide future research for cereals and sustainable cereal-based systems.

Nkolbisson TLU

Access to seeds was one of the factors cited by most farmers as constraining the adoption and retention of improved varieties. Women placed importance on consumption and marketing qualities of maize (taste, color and cob size) while men's interest was in production performance (yield and maturity). Farmers still prefer local cassava over improved varieties. As recommended by breeders, IRA variety 8034 is preferred by farmers only when transformed (foufou).

CMS 8704 and CMS 8501, and hybrid varieties (8321-18 and 8644-31) performed equally well under farmers' conditions and at all fertility levels in on-station trials. DMR-ESR-W was rated poorly by farmers. *Calliandra* biomass in hedgerow intercropping did not affect maize yields in Nkol-Fep village, but substantially increased maize yields in relatively poor soils in Kiki village. *Mimosa* significantly suppressed weed growth in Ntui (Forest-transition Zone). Additional *Calliandra* seedlings were raised by farmers at the village level and extension agent training continued with emphasis on agro-forestry interventions.

Economic Analysis

The main research activity of the Economic Analysis Unit was a country-wide resource management survey. Fieldwork was completed and data analysis is substantially finished. In support of IRA Research Services, the EAU helped revise research priority rankings and budgets, prepared a new Performance Contract, and defined objectives and performance indicators for all of IRA's programs. A research management system was designed and pre-testing of new programming procedures is underway. Implementation started on a TLU rates of return study. Priority setting workshops were planned, but have been suspended until IRA strikes are resolved. Two conference papers were written on linkages between economic analysis, research policy and farming systems research.

Soil/Agroforestry

Overall, the Unit has made some good progress towards solving some of the key soil-related constraints in our zone of service. These are nitrogen deficiency and low phosphorus availability to crops due to soil acidity and fixation. We have explored the use of organic manuring to address these problems. Our impression is that the green manures supply more nitrogen and less phosphorus but enhance the availability of fertilizer phosphorus to crops in acid soils. The green manure crops which show promise in this respect are: *Mucuna, Crotalaria, Canavalia, Tephrosia*. As expected, the performance of a green manure crop at a particular location is a function of the site characteristics.

In our area, *Calliandra* performs best. By aiding initial growth of *Leucaena* with starter manure, its performance may be comparable with that of *Calliandra*. The advantage of using *Leucaena* is that its seed production is more prolific than that of *Calliandra*.This is important from the standpoint of technology dissemination considering the fact that *Leucaena* seeds cost a fifth (1000 CFA/kg) of that of *Calliandra*. *Cassia spectabilis* also grows well but it is a non nitrogen fixer. Although *Albizia, Erythrina* and *Miletia* may be suitable as agroforestry species elsewhere, they cannot be considered as such in our zone of operation

Legume

During the 1992 cropping season research activities concentrated on:

Testing of cowpea varieties to identify the high yielding and adapted ones to Northern Cameroon,
Maintaining a working collection of selection of parents in varietal trials and hybridization,
Evaluating segregating population of crosses for selection for virus resistance, dual purpose (seed and fodder) and for seed characteristics,
Evaluating cowpea genotypes at various insecticide combinations, different dates of planting, intercropping with sorghum and
Purifying varieties by selection for virus resistance.

The analysis of the results showed that Varieties of cowpea with high yield potential and adapted to Northern Cameroon could be obtained. Some varieties identified from the 1991 trials confirmed their potential in regional trials. Cowpea varieties with good yield potential have been identified at low insecticide application, and adapted to both pure and intercropping systems. Cowpeas with dual purpose characteristics (grain and fodder) exist in the pool of material tested. Cowpea varieties with desirable seed characteristics (big and white) were also obtained. Soybean varieties with good yield potential could also be obtained.

Plant Pathology Bambui

Two operations (with six activities) were carried out in the 1992 cropping season on maize. Screening varieties for diseases such as rots, rusts, blights, *phaeosphaeria* leaf spot (PLS) and monitoring of these diseases were our goal. COCA, and SYN-4 were resistant to stalk rot incited by 3 fungi. Of the 19 inbreds and 18 composites tested for their resistance to rust and blight, four in each case showed some resistance. Few were moderately resistant and many were susceptible. Some sources of resistance are available. *Diplodia* leaf stripe though present in one location was a threat in 1991. EC573 and SYN-4 are good sources of resistance to the pathogen considering the infection rate. Of the inbreds and composites tested at Mbiyeh and Santa for their resistance to *Phaeosphaeria* leaf spot, only EC573 and Ndu local showed sign of tolerance. Collaborative work with TLB demonstrated that PLS can also be a lowland disease. Visits by Dr.Cardwell from IITA and travel to Niamey, Ibadan, and Patancheru were very beneficial to the unit.

Highland Cereals Entomology

During 1992 field research activities which involved visiting other Provinces were slowed down by the socio-political problems of the country and the frequent prolonged IRA workers' strikes.

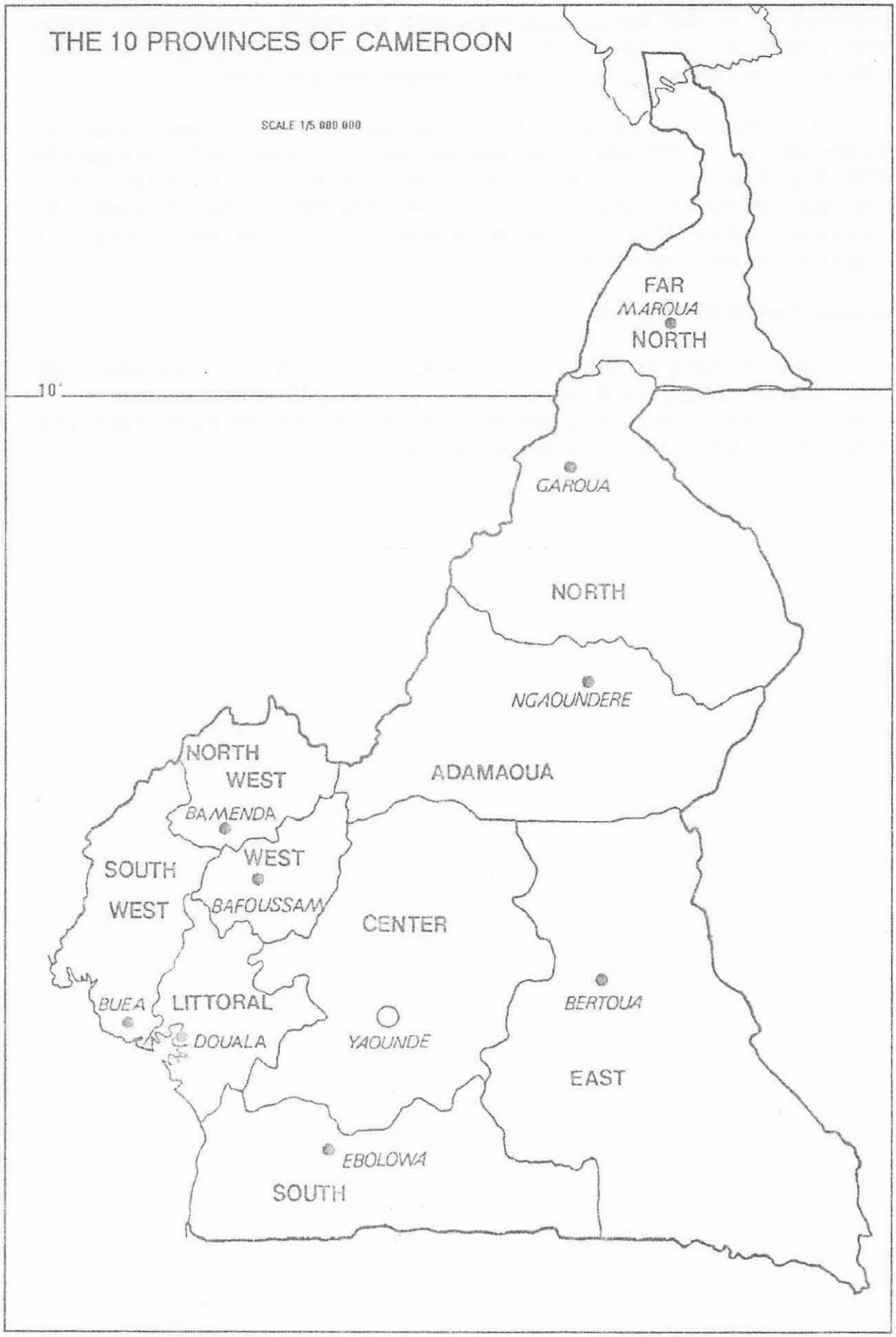
There was considerable progress towards achieving the objectives of the first priority operation - the survey of the use of natural plant materials by farmers for grain storage pest control. Over 850 names of users of natural plant materials have been documented in the West (300) and North West (550) Provinces. About 100 users were interviewed.

Two laboratory experiments installed in November 1991 were terminated including an experiment to test the efficiency of SOFAGRAIN and SUMCOMBI grain storage insecticides for the protection of stored maize under two popular peasant farmers' storage methods and hermetic storage of high and low moisture content maize using 25 liter plastic containers to investigate its effects on insect population and grain quality.

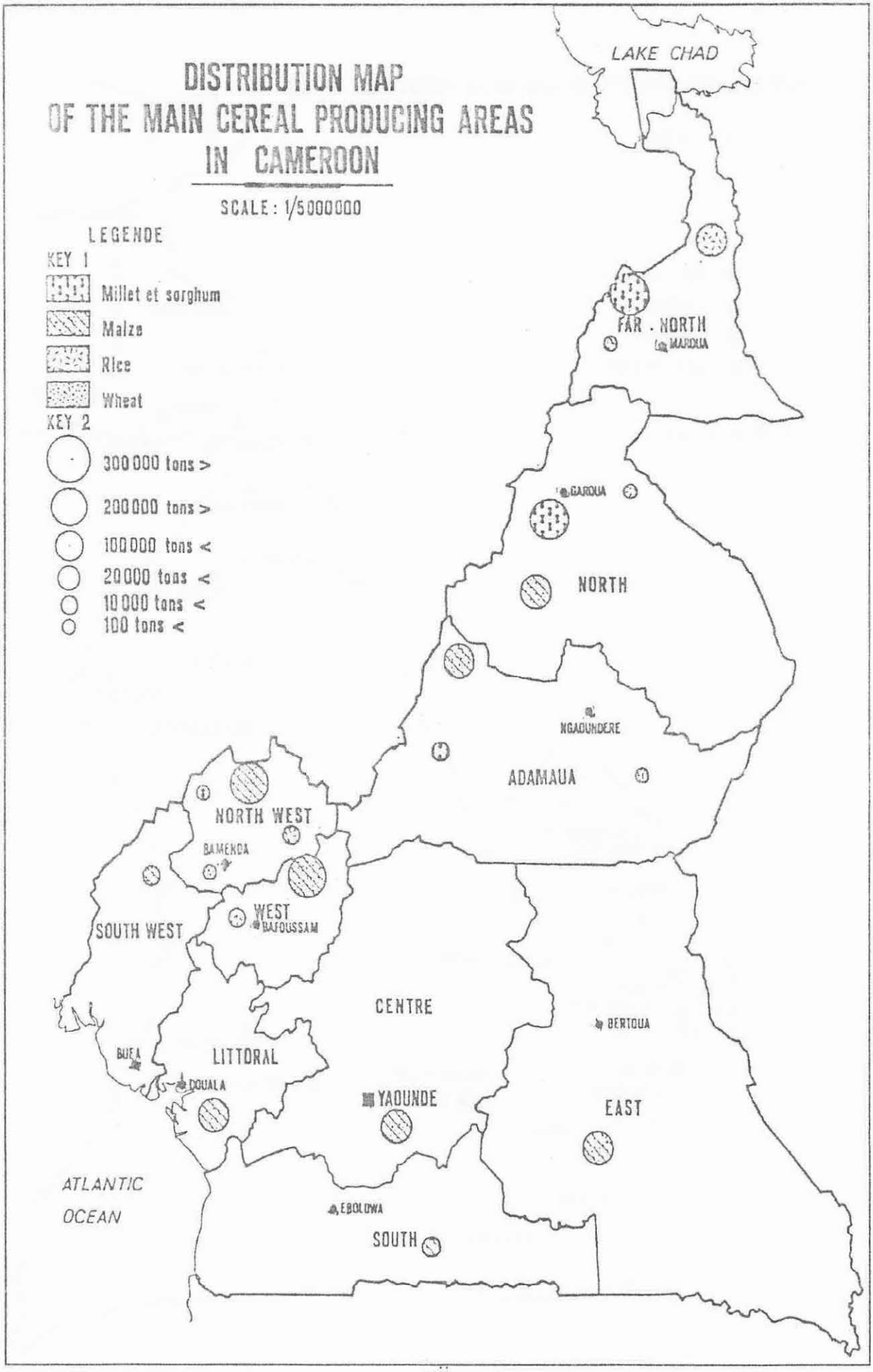
Rice entomological activities extended to the North and Extreme North Provinces for the first time during 1992 after the planning meeting of the Integrated Pest Management (IPM) Task Force in Bouake, Côte d'Ivoire organized by WARDA in February, 1992. Some important rice insect pests were identified including the stalk-eyed Fly-a stemborer *(Diopsis sp.)* and the African Gall Midge *(Orseolia oryzae)*. Some ten rice trials were screened for stemborer resistance.

Lowland Cereals Entomology

Given the means available we were able to initiate a total of 6 experiments during 1992. Due to unfavorable soil conditions one experiment suffered poor germination. A second trial which required observations during an entire year was lost due to frequent IRA strikes. The remaining four trial results are reported.


THE 10 PROVINCES OF CAMEROON
SCALE 1/5 000 000
FAR
MAROUA
NORTH
10°
GAROUA
NORTH
NGAOUNDERE
NORTH
WEST
ADAMAOUA
BAMENDA
WEST
SOUTH
WEST
BAFOUSSAM
CENTER
BUEA
LITTORAL
DOUALA
YAOUNDE
BERTOUA
EAST
EBOLOWA
SOUTH


I R A INFRASTRUCTURE AND NCRE RESEARCH SITES
SCALE 1/5000000
DIRECTORATES
CENTRES
STATIONS
SUBSTATIONS
10°
KOUSSERI
GUETALE
MAGA
MAROUA
YAGOUA
MAKEBI
SOUCOUNDOU
TCHATIBA
SANGUERE
FIGNOLE
TCHOLLIRÉ
NDOCK
TOUBORO
NGAOUNDERE
SANTA
BAMBUI
BABUNGO
FOUNBOT
DCHANG
SANTCHOU
BELABO
BANGANGTE
KUMBA
LYSOKA
NJOMBE
BAROMBI-KANG
BERTOUA
EKONA
NKOLBISSON
DOUALA
YAOUNDÉ
ABONG-MBANG
LA DIBAMBA
KRIBI
NKOEMVONE


DISTRIBUTION MAP
OF THE MAIN CEREAL PRODUCING AREAS
IN CAMEROON
SCALE : 1/5000000
LEGENDE
KEY 1
Millet et sorghum
Maize
Rice
Wheat
KEY 2
300 000 tons >
200 000 tons >
100 000 tons <
20 000 tons <
10 000 tons <
100 tons <
LAKE CHAD
FAR - NORTH
MAROUA
GAROUA
NORTH
NGAOUNDERE
ADAMAUA
NORTH WEST
BAMENDA
WEST
BAFOUSSAM
SOUTH WEST
CENTRE
BERTOUA
BUEA
LITTORAL
DOUALA
YAOUNDE
EAST
ATLANTIC
OCEAN
EBOLOWA
SOUTH

1. ADMINISTRATION

1.1 INTRODUCTION

The NCRE Administration is responsible for all administrative coordination of the project. Primary activities are centered at Nkolbisson. Administrative staff at each NCRE location are supervised by the NCRE coordinator at that location.

The overall goal of project administration is to assist researchers in their achievement of project goals and objectives. The administration also maintains liaison among the sponsoring organizations; IRA, IITA and USAID. The project administration consists of the Chief of Party, Deputy Chief of Party and an Administrative Officer. The Chief of Party is in charge of overall project coordination and staff productivity. The Deputy Chief of Party coordinates publications, counterpart training, and reports. The Administrative Officer is in charge of daily details of accounting, inventory and local staff supervision.

During the first 10 years of NCRE the administration concentrated on addition of programs and streamlining administrative procedures for an increasing number of technical staff. During the period 1991-1994 emphasis is being placed on phasing out of expatriate staff and takeover of existing programs by IRA national researchers and administration.

1.2 SUMMARY OF PROGRAM ACTIVITIES

During 1992 the parent ministry of IRA, the Ministry of Higher Education, Computer Services and Scientific Research (MESIRES) was split in to two. A new Ministry of Scientific and Technical Research (MRST) was created to oversee IRA activities. The Director of IRA, Dr. J. Ayuk-Takem, was named Minister of MRST. He assumed his duties in April while retaining the post of Director of IRA.

The IITA Highland Maize Breeder, Dr. N. Beninati, left due to personal reasons. Because of the short time left in the project and the presence of capable National counterparts he was not replaced. In October the project was saddened by the unexpected death of the NCRE Project Officer, Mr. Quincy Benbow. Many important project functions were delayed because of his passing away . Additional problems were caused by political unrest and sporadic strikes by IRA workers. All programs continued their work although some were forced to reduce operations. Highway robberies in some areas forced curtailment of field surveys. Two long term IITA staff phased out of NCRE at the end of 1992. Dr. H. Talleyrand left the Cereals Agronomy Unit at Garoua and Mr. Dermot McHugh left the Bambui Testing and Liaison Unit in Bambui. They were replaced by their national counterparts.

A locally produced NCRE information bulletin was distributed at the Chief of Parties meeting in May. A professionally composed information brochure was completed and printed in the USA. Copies have been distributed in Cameroon and USA.

Equipment was received and distributed including project vehicles. Old project vehicles were transfered to IRA. A shipment of spare parts for office equipment was also received. The Winrock Purchasing Officer, Mr. Ron Hubbard, and Matrix International Shipping Manager, Mr. Paul Smith, visited NCRE to arrange purchases and shipments. Final purchase orders were filled by Winrock and shipped to Cameroon.

Project financial and inventory procedures were reviewed by the IITA Internal Auditor, Mr. G. McIntosh. The project moved to change imprest accounts to a fixed balance system.

Mrs. L. Enyong completed in-country research activities for her PhD program at Virginia Polytech. Mr. Mbassa Ndioro returned from a successful completion of his Msc program in Maize Breeding at Minnesota State University. He resumed duties at Bambui station. Mr. Mboussi à Messia left for Msc training at Arkansas State University. In December, the Chief of Party visited 11 long term degree trainees and their academic advisors in the USA. He also met with Winrock training staff. Computer training courses were held at Garoua, Ekona and Nkolbisson on the use of WordPerfect and SYSTAT/MSTAT. These courses were held with the assistance of Mr. C. Mouang and ODA technicians Mr. G. McLaren, Mr. H. Hockey and Mr. D. Parker. Mr. G. Manners of ODA also gave a scientific writing course during the course at Ekona.

A general project meeting was held in Yaounde to discuss new project directions and details of operation for the coming year. All IITA staff and counterparts attended.

1.3 ACCOMPLISHMENTS

Objectives	Activities	Accomplishments
Operation 1: Provide overall planning and supervision of technical performance of technical Assistance team.		
1. Advice available to researchers.	1.1 Organize meetings to prepare research work plans.	Work plans and progress were reviewed with each research unit.
	1.2 Visit research activities in the field.	All locations were visited at least once by the Chief of Party and Administrator during 1992.
	1.3 Organize and participate in field tours.	Done by individual technicians.
Operation 2: Facilitate liaison between USAID, IITA, IRA and other organizations cooperating with the project.		
2.1 Make People aware of project activities and accomplishments.	2.1 Disseminate project reports.	Project reports completed and distributed.
2.2 Coordinate Project activities.	2.2 Organize and participate in meetings and social events.	Various meetings were attended in all parts of the country. Weekly coordination meetings were held with local administrative staff.
Operation 3: Provide leadership to technical assistance team in applying research to local problems.		
3.1 Rational work Plans	3.1 Organize and participate in meetings to discuss work plans.	Done during stations visits.
	3.2 Organize annual planning meeting with users of project research results.	Done in Garoua.

Objectives	Activities	Accomplishments
Operation 4: Guide and assist Deputy Chief and Administrative Officer in providing administrative and logistical support to staff.		
4.1 Staff able to accomplish research objectives.	4.1 Set priorities for tasks.	Regular weekly meetings.
	4.2 Assist in execution of tasks when necessary.	Daily interaction.
Operation 5: Plan and coordinate long and short-term training for national counterparts.		
5.1 Placement of candidates and trainees.	5.1.1 Consult appropriate persons for selection of candidates.	Selection finished.
	5.1.2 Help develop course programs.	Mr. Mboussi placed at Arkansas State Univ.
	5.1.3 Advise national counterparts.	Various meetings.
	5.1.4 Visit students and professors ar their universities.	Done for most in December.
Operation 6: Computerize accounting and financial reporting.		
6.1 Accurate and timely financial reports and analyses.	6.1.1 Refine and debug accounting software.	Version 3 in field use.
	6.1.2 Write manual for software.	No progress during this period.
	6.1.3 Distribute programs and train personnel.	Minor consultations during this period.
Operation 7: Perform regular inventory and supplies checks.		
7.1 Maintain an accurate and up to date list of equipment and supplies.	7.1 Annual inventory and supply checks.	Yearly check completed.

Objectives	Activities	Accomplishments
Operation 8: Initiate project publication system.		
8.1 Print a series of publications concerning project results.	8.1.1 Establish formats.	Formats established for 3 types of publications.
	8.1.2 Edit and produce final copy.	Draft copies of IRA Pamphlets and Bulletins produced.
	8.1.3 Print copies for distribution.	No progress during 1992.
	8.1.4 Distribute copies.	No progress during 1992

1.4 VISITORS

A total of 65 official visitors passed through the NCRE administrative offices during 1992. Among them were the CIRAD representative to Cameroon, the minister of MRST and officials from 10 different countries.

2.1 HIGHLAND MAIZE BREEDING

2.1.1 INTRODUCTION

The Highland Maize Breeding Unit is responsible for the development of varieties adapted to improved and current farming systems between 1000 and 2500 meters altitude. The target zones are found in the Northwest, West and Adamaoua Provinces and include a large range of soil types and farm sizes. The Western Highland, comprising the North West and West Provinces, cover less than 10% of the land area in Cameroon, but contains 25% of the population, and produces over 60% of the national maize crop.

The goal of the unit is to develop a comprehensive breeding program which will continuously provide seed of new varieties to the seed multiplication and distribution organizations, well past 1994. Past work by this unit has emphasized the development of a germplasm base, which has been improved to the point of producing open-pollinated, hybrid and synthetic varieties. After confirmation by TLU, the best of these varieties will be available for foundation seed production.

While the unit has, in recent years, put an emphasis on selecting inbred lines for hybrids, we will gradually return the emphasis to population improvement. The proposed installation of a maize streak virus screening facility means emphasis will be placed on developing virus resistant germplasm.

The rapid spread of varieties in farmers' fields depends, in large part, on the ability of the seed production system to provide sufficient quantities of good quality seed, and of the extension system to disseminate the seed and the appropriate information on its use. The success of hybrids in Cameroon is likely, in the next four years, to depend on the success of the private seed industry in the country. The success of the streak screening nursery will depend on the ability of national scientists to learn the necessary techniques and to manage the facilities. Guidance for this will be provided by the TA with technical backstopping provided by IITA.

2.1.2 SUMMARY OF ACTIVITIES

Progress continued in the major components of the breeding program during 1992. Kasai SR, synthetic-4 and ATP-90 confirmed their potentialities as releasable varieties in the midaltitudes. Kasai SR will replace the normal Kasai already released. In the highland zones, Improved Ndu Local can be recommended for release while HAP is still being improved for *Phaeospheria maydis*, a highland maize leaf spot disease. The hybrid program has yielded good and productible single cross varieties that could be extended to medium and large scale farmers if there were a company that could produce seeds for this type of farmers. The following inbred lines are available at breeder's level for release: 87036, 88069, 88094, 88099, 89182, 89258, 89274, C70, M131, Z28, 90323. Further recombinations of ATP SR, Early White SR, Kasai SR, Synthetic-4 yellow SR, Synthetic-4 White SR and synthetic-5 yellow took place, while by the same time, Early Yellow formation was started.

Seven open pollinated varieties were sown in isolation plots to obtain breeder's seed. The seed multiplication sub unit of the breeding program produced 1200 kg of Kasai, and hundreds of kg of coca, Bacoa, Ekona Yellow and Ekona White for foundation seed.

Small programs of specialty corn breeding resulted in the identification of three good popcorn inbreds lines in two hybrid combinations and 85 good sweet corn families recombined to further improve germination of the Sh sweet corn type. Though the normal work schedule was sometimes disturbed by workers strikes and socio-political agitations, more than 90% of the goals were realized in 1992.

1992 was a special year concerning selection of resistance to the major diseases. Major disease infections were not significant this year across locations and less interest was shown in scoring them in our trials.

Due to the departure of the T.A. in october 1992, and budgetary constraints the project is facing, an attempt is being made to ask collaborators to finance their trials. The program is now being led by the newly returne National Counterpart from the US. with MSc degree.

2.1.3 ACCOMPLISHMENTS

Objectives	Activities	Accomplishments
Operation 1: Develop Germplasm		
1.1. Improve source populations.	1.1 Progeny testing, screening and intercrossing.	1. High altitude local germplasm evaluated for agronomic traits and *phaeospheria* sp resistance 2.Midaltitude local germplasm evaluated for disease resistance and agronomic traits. 3. CIMMYT highland germplasm evaluated at Mbiyeh for earliness and disease resistance.
1.2. Select inbreds for hybrids and synthetics.	1.2. Inbreed, test cross and select lines for hybrids or recombination.	4. Further recombinations of ATP, Synthetics 3,4 and 5, and Early White SR versions, and Early Yellow made in off-season nursery at Foumbot.

Objectives	Activities	Accomplishments
		5. Selected lines harvested and stored in the seed room on station.
Operation 2: Test varieties and hybrids		
2.1. Select best hybrids and inbreds for eventual release.	2.1. Preliminary and advanced hybrid trial at several locations.	1.Agronomic characteristics and disease tolerance evaluated in National Variety Trials.
2.2. Identify new varieties for eventual release.	2.2. Compare new varieties with old in multilocational national and international trials.	2. Agronomic characteristics and disease reactions evaluated in hybrid trials
Operation 3: Maintain breeder seed		
3.1. Grow breeder seed for purity and improvement.	3.1 Ear-to-row selection in open-pollinated varieties.	1. Selected families harvested and stored as breeder seed for further use.
		2. Seed distributed to TLU's and Agroforestry units and MBB multiplication sub-unit for testing and foundation seed increase.
3.2. Monitor foundation seed production.	3.2 Visit isolations, provide logistical assistance and advise.	3. Insufficient data collected on ATP.
3.3. Provide seed for collaborators.	3.3. Included in 3.1 and 3.2	4.Limited amounts of seed of open-pollinated varieties produced. hybrid seeds still in off-season nursery.

2.1.4 RESEARCH FINDINGS

Germplasm development

Two collections of local germplasm were evaluated at mid-altitude and high altitude level at Babungo (1100 m) and Mbiyeh (2000 m) respectively. None of the locally collected germplasm was declared satisfactory at mid-altitude level either for their agronomic characteristics or for their yield, when compared to the Synthetic 4 or Babungo MSR 89 used as checks (Table 1). At the high altitude location of Mbiyeh, where yield, earliness and resistance to *Phaeospheria* sp. are the major trials under selection, two locally collected varieties (Ndu White and Nkambe 1 - White) were selected for their good yield performance, disease reaction, and other agronomic characteristics (Table 2).

A total of 441 lines were selected from the source populations Syn A4 and Syn B4 S_2 lines. 142 lines from IITA background at different inbreeding stages (S_3 - S_6) were selected. 505 S_3 lines were also selected from Pop 32 x Syn A_4 S_2 lines as well as 488 S_2 lines from EMSR C_2 S_1 lines, the source population of early maturity genes. Future progress of the program was expected from this diversity of germplasm but budgetary problems may force their storage. 15 new inbred lines from 1991 test crosses selected for their good performance in preliminary hybrid are currently crossed in 25 different combinations to form advanced hybrids that will be tested in 1993.

From the second pop corn evaluation, three inbred lines (I28, SG 32, SG 1533) were selected to form single hybrid combinations. They will be maintained for an eventual release if need arises for the specialty corn.

The small sweet corn program emphasized the improvement of the germination of the Sh. type with the actual off season recombination of the best 87 best germinating families out of 306 harvested from the first season nursery in 1992.

Twenty nine ((29) preliminary hybrids are under formation in an off-season nursery. Test crosses have been formed from the remainder of combinations of testcross derived lines from 1991.

Some progress was made with the maize streak virus varieties advancement. Converted varieties (Coca- SR, Kasai SR, Synthetic 3-SR, ATP-SR, Syn 4-W-SR, Syn 4-YSR, Early White-SR) underwent their third recombination, this year, and more improvement of streak resistance is planned for 1993.

In the high altitude zone, High Altitude Population (HAP) was selfed to improve its resistance to *Phaeospheria maydis* which has caused delay of its release to farmer in its target environment.

Variety and Hybrid Testing

Three National Variety Trials (NVT) were sown in 1992 at Foumbot, (1000 m) Babungo (1100 m), Mfonta (1300 m), Mbang Birni (1100 m) for NVT - Midaltitude Late

(NVT-MAL) and NVT-Midaltitude Early (NVT-MAE) and Mbiyeh (2000 m) for NVT - High Altitude (NVT-HA).

In NVT-MAE seeds of the KASAI were contaminated during seed preparation and tables 3 and 4 present the data of the trial, omitting that entry. Kasai SR, the new entry in the trial, ranked first in yield across locations, and was significantly higher yielding (<0.05) than Early White, EMSR, and the Bacoa check. Early White was not earlier than Kasai SR, though the maturity difference is at the limit of statistical significance ($P<0.05$).

In NVT-MAL fourteen more varieties (including check) were tested at four sites. The Mbang Birni location was dropped during the data analysis because of unreliable data as well as the poor management of the trial. Tables 5 and 6 present the results of NVT-Mal at 3 locations. These tables show the potential of synthetic 4 and the 1990 ATP versions. If no objections come from TLU and Pathology Units, these two varieties should be released to farmers in 1993 in their present form, while testing of their newly converted streak resistant versions will go on. Advanced hybrid trials (Sets 1 and 2) were sown at four locations in 1992. Tables 7 - 10 show the yield and agronomic characteristics of the highest yielding crosses in the two trials, along with the check entry performances. According to the data hybrids 88069 x 87036, 88094 x M131, 90219 x 88094, M131 x 89274, 89258 x 89182, 89223 x 89258 could be released. In addition to the inbred parents in the above crosses, many others have been selected for multiple purpose use.

Table 1: Agronomic characteristics and yield of midaltitude local collection trial (LCMA) sown at Babungo as a RCBD with 2 replications in 1992.

	CHARACTER						
Entry	Days to 50% Silk	Ear Height (cm)	Husk cover (1-5)	Plant Aspect (1-5)	Ear Aspect (1-5)	Ear Rot (1-5)	Yield (t/ha)
Koutoukoup	74	176	1.5	2.8	2.3	2.3	6.1
Djindoum	75	182	1.3	2.5	2.3	2.3	6.6
Ngouemdam	75	149	1.8	3.3	2.0	3.3	6.0
Baham	74	149	1.3	2.3	2.5	3.0	4.4
Kouoptamo	74	168	2.0	2.5	1.8	2.8	6.5
Synthetic 4[1]	74	138	1.8	1.8	1.0	1.8	10.7
Mbafam	68	128	1.5	2.3	2.8	3.0	5.4
Vevobo	75	198	1.0	2.8	2.0	2.5	7.4
B'go MSR 89[2]	73	147	2.0	2.3	1.0	2.0	8.6
Trial Mean	73	159	1.6	2.5	1.9	.6	6.8
LSD (0.05)	1	NS[2]	NS	NS	.5	.2	1.5
S.E.	.4	22.9	.7	.6	.2	9.9	.7
CV(%)	.5	14.4	44.2	23.5	12.1		9.6

1 - Improved open pollinated variety checks.
2 - Non significant at 0.05 probability level.

Table 2: Agronomic characteristics and yield, and disease reaction of 13 locally collected highland maize gerplasms and 2 checks sown at Mbiyeh as a RCBD with 2 replications in 1992.

	CHARACTER							
Entry	Days to 50% Silk	Ear Height (cm)	Husk cover (1-5)	Plant Aspect (1-5)	Ear Aspect (1-5)	Ear Rot (1-5)	Phaeosp-heria sp (1-5)	Yield t/ha
Tabeken 2-W	118	112	1.5	3.0	3.5	3.3	3.5	2.9
Tabeken 3-W	112	147	1.8	2.8	2.5	2.8	2.5	4.9
Tabeken 4-Y	94	118	1.3	3.0	3.0	3.8	3.3	4.3
Ndu Yellow	93	138	2.3	2.5	2.5	2.5	3.5	6.5
Ndu - White	107	174	2.0	2.8	2.3	2.5	2.0	8.7
Tabenken1-Yellow	91	105	1.3	3.0	3.0	3.8	3.0	4.5
Nkambe 1 -Yellow	99	154	1.3	2.8	2.8	2.5	3.0	5.6
Nkambe 2-White	107	172	1.5	2.8	2.3	2.3	2.0	8.0
Kakar Yellow	98	142	2.0	2.8	2.5	2.8	3.0	7.4
Mesaje 5-Yellow	95	149	1.8	2.8	2.8	3.0	3.3	6.5
Bangou (kako)	105	134	1.8	3.0	2.3	4.0	3.3	3.7
Bangou (B'goue)	111	172	1.8	2.8	3.3	3.5	3.5	3.6
Metchou 1	115	156	1.8	2.8	3.5	3.5	3.5	3.1
I. Ndu Local[1]	116	163	1.5	2.5	2.3	2.0	2.0	10.8
HAP[1]	112	191	2.0	2.5	2.3	2.0	2.5	9.1
Trial Mean	105	148	1.7	2.8	2.8	3.0	3.0	5.0
LSD (0.05)	8	30	NS[2]	NS	.8	.7	1.0	2.5
S.E.	4	14	.4	.5	.4	.3	.4	1.2
CV(%)	3.8	9.3	25.7	16.4	9.4	11.6	3.0	19.3

1 - Improved open pollinated checks
2 - NS = Non significant at 0.05 probability level.

Table 3: Grain yield (t/ha) of 3 varieties and 1 check in NVT, Mid-Altitude Early sown as a RCBD with 4 replications at 4 locations in 1992.

	LOCATIONS				
ENTRY	Foumbot	Babungo	Mfonta	Mbang-Mbirni	Entry Mean
Kasai SR	10.1	9.7	7.0	7.3	8.7
Early White	9.2	8.1	6.9	6.0	7.5
EMSR	8.9	7.7	5.9	6.2	7.2
Control					
Bacoa[1]	8.4	8.5	6.3	6.2	7.3
Trial Mean[2]	9.5	8.7	6.7	6.4	7.8
LSD (0.05)	.6[4]	NS[3]	.9	.9	.5
S.E.	.3	.7	.4	.4	.5
CV (%)	4.4	11.6	8.4	8.7	8.6

1- Open pollinated variety check
2 - 5 entries in a trial
3- Non significant at 0.05 probability level
4- Location x variety interaction used as error term.

Table 4: Agronomic characteristics of 3 varieties and 1 check in NVT - Midaltitude Early sown as a RCBD with 4 replications in 4 locations in 1992.

	CHARACTER					
Entry	Days to 50% Silk	Ear Height (cm)	Husk cover (1-5)	Plant Aspect (1-5)	Ear Aspect (1-5)	Ear Rot (1-5)
Kasai SR	71	103	2	2	2	3
Early White	69	104	2	2	2	3
EMSR	68	107	2	2	2	3
Control						
Bacoa[1]	72	126	2	3	2	3
Trial means[2]	71		1.9	2.3	2	3
LSD (0.05	2[4]	NS[3]	NS	.3	NS	NS
S.E.	1	26	.2	.2	.3	.3
CV (%)	2.3	60	23	19	17	19

1- Open pollinated variety check ; 2 - 5 entries in a trial
3- Non significant at 0.05 probability level ;
4- Location x variety interaction used as error term.

Table 5: Grain yields (t/ha) 13 entries in NVT-Midaltitude Late Trial sown as a RCBD with 4 replications at 4 locations in 1992.

	LOCATIONS			
ENTRY	Foumbot	Babungo	Mfonta	Entry Mean
Syn 4	9.7	10.3	7.9	9.3
ATP - 90	8.8	9.4	8.1	8.7
MSR - 89	9.5	8.4	8.0	8.6
ATP - 89	8.8	9.3	7.3	8.5
Kasai SR	8.4	9.1	7.5	8.6
ATP - EV 89	9.1	8.9	6.8	8.3
Syn 3	8.7	9.5	5.8	8.0
Coca SR	7.4	9.3	7.4	8.0
MSR - 87	8.9	8.2	6.8	8.0
Across-87 MSR	7.9	8.5	5.9	7.9
Control				
Coca[1]	7.1	9.0	7.9	8.0
Shaba[1]	8.2	9.3	7.6	8.4
ZS 206[2]	10.5	11.1	10.0	10.5
Trial Mean[3]	8.8	9.2	7.5	8.5
LSD (0.05)	.9	1.3	1.3	1.2[4]
S.E.	.4	.7	.7	.6
CV (%)	7.0	10.0	10.0	11.0

1 - Open pollinated variety checks. 2 - Commercial hybrid check
3 - 13 entries in the trial 4 - Location x variety interaction used as error term.

Table 6: Agronomic characteristics of 13 entries in NVT Midaltitude late trial sown as a RCBD with 4 replications at 4 locations in 1992.

Entry	CHARACTER					
	Days to 50% Silk	Ear Height (cm)	Husk cover (1-5)	Plant Aspect (1-5)	Ear Aspect (1-5)	Ear Rot (1-5)
Syn 4	74	120	2.0	2.0	2.1	2.5
APT - 90	73	132	2.0	2.0	2.1	2.0
MSR - 89	73	136	2.0	2.2	2.0	2.6
ATP 89	74	140	2.1	2.1	2.0	2.5
Kasai SR	72	116	2.0	2.0	2.2	2.6
ATP EV 89	74	143	2.1	2.0	2.0	2.1
Syn. B	72	123	2.0	2.0	2.0	2.5
Coca SR	70	138	2.2	2.1	2.1	2.4
MSR 87	75	126	2.0	2.0	2.0	3.1
Across 87 MSR	76	131	2.2	2.6	2.3	2.9
Control						
Coca[1]	74	155	2.4	2.4	2.1	2.5
Shaba[1]	75	136	2.0	2.3	2.0	2.7
ZS 206[2]	74	124	2.1	2.0	1.1	2.4
Trial Mean[3]	73	133	2.0	2.1	2.0	2.5
LSD (0.05)	2[4]	10	.3	.4[4]	.5[4]	.5[4]
SE	1.1	5	.2	.2	.2	.2
CV (%)	3	11	20	18	22	18

1 - Open pollinated variety checks.
2 - Commercial hybrid check
3 - 13 entries in the trial
4 - Location x variety interaction used as error term.

Table 7: Grain yield (t/ha) of 10 top yielding + 2 check entries in the advanced hybrids trial, set 1 sown as a RCBD with 4 replications at 4 locations in 1992.

ENTRY	LOCATIONS				
	Foumbot	Babungo	Mfonta	Mbang-Mbirni	Entry Mean[1]
88069 x 87036	13.2	12.0	6.9	10.6	10.7
88094 x M131	12.6	12.3	6.9	9.6	10.4
88069 x 88091	13.4	11.6	6.8	9.3	10.3
90219 x 88094	11.2	11.3	6.8	10.2	9.9
89223 x 88099	10.7	10.3	7.3	9.2	9.4
* 90117 x 90323	11.1	9.5	7.4	8.9	9.2
88099 x 89182	11.7	10.0	6.4	8.6	9.2
** 90251 x 88094	11.5	10.7	6.1	8.2	9.1
88094 x 90204	10.8	9.9	6.8	8.8	9.1
M131 x 88099	10.6	10.7	5.8	9.1	9.0
Controls					
ZS 206[1]	11.3	10.5	7.8	8.6	9.5
Syn 4[2]	10.2	9.1	5.7	7.8	8.2
Trial mean[3]	11.2	10.2	6.3	8.8	9.1
LSD (0.05)	1.0	1.0	NS[4]	.9	1.0[5]
S.E.	.5	.5	1.8	.4	.5
CV (%)	6	7	20	10	10

1 - Comercial Hybrid Check.
2 - Open-Pollinated Variety Check.
3 - 22 Entries in a Trial.
4 - Non Significant at .05 probability level.
5 - Location x Variety interaction used as error.

* Not streak resistant (90117)

** Not registered or stored (90251)

Table 8: Agronomic characteristics fo 10 top yielding + 2 check entries in advanced hybrids trial, set 1 sown as a RCBD with 4 replications at 4 locations in 1992.

Entry	CHARACTER					
	Days to 50% Silk	Ear Height (cm)	Husk cover (1-5)	Plant Aspect (1-5)	Ear Aspect (1-5)	Ear Rot (1-5)
88069 x 87036	78	126	2.1	2.3	1.9	2.3
88094 x M131	75	132	2.2	2.1	2.0	2.3
88069 x 88091	76	142	2.5	2.2	2.2	2.6
90219 x 88094	76	135	2.1	2.4	1.6	1.8
89223 x 88099	75	132	1.9	2.2	1.9	2.0
90117 x 90323	79	120	2.3	2.1	1.8	1.9
88099 x 89182	75	125	2.5	2.2	2.1	2.3
90251 x 88094	76	130	1.8	2.3	1.9	1.9
88094 x 90204	74	128	2.7	2.2	2.1	2.2
M131 x 88099	76	121	2.0	2.1	2.5	2.3
Controls						
ZS 206[1]	76	127	2.4	2.4	1.9	2.6
Syn 4[2]	77	124	2.0	2.6	2.9	2.7
Trial mean[3]	76	128	2.1	2.3	2.1	2.3
LSD (0.05)	2.0[4]	15	.3[4]	.4[4]	.6[4]	.4[4]
SE	1	7	.2	.2	.3	.2
CV (%)	3	17	15	18	21	18

1 - Commercial hybrid check
2 - Open pollinated variety check
3 - 22 entries in the trial
4 - Location x Variety interaction used as error term.

Table 9: Grain yield (t/ha) of 10 top yielding + 2 checks entries in advanced hybrids trial, set 2 sown as a RCBD with 4 replications at 4 locations in 1992.

ENTRY	LOCATIONS				
	Foumbot	Babungo	Mfonta	Mbang-Mbirni	Entry Mean[1]
90323 x 88069	14.0	12.4	8.4	8.5	10.9
M131 x 89274	12.2	11.4	5.3	9.8	9.7
89258 x 89182	12.9	11.1	5.1	9.2	9.6
89223 x 89258	11.7	10.9	6.5	8.4	9.4
8556-6[1]	10.7	10.3	7.8	8.1	9.2
Z28 x 89223	11.3	10.2	6.8	7.7	9.0
90251 x 88099	11.1	10.4	6.6	7.8	9.0
YIF 64[2]	11.4	10.6	4.8	8.8	8.9
90251 x 89223	12.1	10.6	5.1	7.7	8.9
M131 x 90323	11.2	10.9	6.4	7.1	8.9
Controls					
ZS 206[3]	10.9	10.3	6.2	8.2	8.9
Syn. 4[4]	10.1	10.3	4.3	7.8	8.1
Trial Mean[5]	11.2	10.3	5.8	8.0	8.8
LSD (0.05)	1.5[6]	1.1[6]	2.1[6]	1.3[6]	1.1[6]
S.E.	.7	.5	1.0	.7	.5
CV(%)	9	7	25	12	12

1 - IITA hybrid
2 - Pioneer hybrid
3 - Commercial hybrid check
4 - Open pollinated variety check
5 - 22 Entries in the trial
6 - Location x Variety interaction used as error term.

Table 10: Agronomic characteristics of 10 top yielding + 2 checks in advanced hybrids trial set 2 sown as a RCBD with 4 replications at 4 locations in Cameroon in 1992.

Entry	CHARACTER					
	Days to 50% Silk	Ear Height (cm)	Husk cover (1-5)	Plant Aspect (1-5)	Ear Aspect (1-5)	Ear Rot (1-5)
90323 x 88069	79	119	2.6	2.6	2.1	2.4
M131 x 89274	77	132	2.1	2.1	2.4	2.5
89258 x 89182	75	115	2.2	2.2	1.9	2.2
89223 x 89258	75	120	1.8	1.8	1.9	2.1
8556-6[1]	77	142	2.2	2.2	2.2	2.5
Z28 x 89223	77	117	2.1	2.1	2.2	2.2
90251 x 88099	75	118	2.0	2.0	2.3	2.1
YIF 64[2]	73	109	2.1	2.1	2.8	2.9
90251 x 89223	76	120	1.8	1.8	2.3	2.1
M131 x 90323	81	123	1.6	1.6	2.1	2.2
Controls						
ZS 206[3]	77	129	2.3	2.3	2.2	2.9
Syn. 4[4]	78	117	2.2	2.2	2.8	2.6
Trial Mean[5]	76	118	2.1	2.2	2.3	2.5
LSD (0.05)	2[6]	11	.5[6]	1.3	.5[6]	.5[6]
S.E.	1	6	.2	.7	.3	.3
CV%	2	14	20	85	17	15

1 - IITA hybrid
2 - Pioneer hybrid
3 - Commercial hybrid check
4 - Open pollinated variety check
5 - 22 Entries in the trial
6 - Location x Variety interaction used as error term.

Table 11: Grain yield (t/ha) of 10 of the most advanced inbred parents from inbred Trials sown as a RCBD with 3 replications at two locations in 1992.

	LOCATIONS		
ENTRY	Foumbot	Babungo	Entry Mean
87036	5.9	8.1	7.0
88069	5.8	7.1	6.5
88094	5.7	6.7	6.3
88099	4.2	5.0	4.6
89182	4.7	5.4	5.1
89258	5.4	7.5	6.5
89274	6.5	7.4	7.0
C70	5.3	5.2	5.3
M131	5.1	5.7	5.4
Z28	5.7	7.2	6.5
Trial Mean[1]	5.5	6.5	6.0
LSD (0.05)	.7	1.1	1.1[2]
S.E.	.4	.6	0.5
CV (%)	7.9	10.7	9.7

1 - 22 entries in the trial.
2 - Location x Variety interaction used as error.

Table 12: Agronomic characteristics of some of the most advanced inbred parents from Inbred Trials sown as a RCBD with 22 entries in 3 replications at two locations in 1992.

	CHARACTER					
Entry	Days to 50% Silk	Ear Height (cm)	Husk cover (1-5)	Plant Aspect (1-5)	Ear Aspect (1-5)	Ear Rot (1-5)
87036	76	113	1.8	2.0	2.1	2.0
88069	77	83	2.7	2.1	2.3	3.2
88094	76	114	1.6	1.8	1.1	2.1
88099	76	117	1.8	1.8	2.1	2.1
89182	75	117	1.3	2.4	2.1	3.1
89258	76	83	1.4	1.8	2.1	2.3
89274	73	115	1.1	2.2	2.0	3.0
C70	75	96	1.3	1.3	2.1	2.1
M131	78	104	1.5	2.1	2.3	3.2
Z28	78	109	1.3	1.2	1.1	3.0
Trial Mean[1]	76	108	1.5	2.0	2.1	2.6
LSD (0.05)	2[2]	15	0.8[2]	.9[2]	.5[2]	.7[2]
S.E.	1.0	7	.4	.4	.3	.4
CV (%)	1.4	12.3	25.4	22.7	14.6	17.0

1 - 22 entries in the trial
2 - Location x Variety interaction used as error term.

2.2 LOWLAND MAIZE BREEDING

2.2.1 INTRODUCTION

The ultimate goal of the lowland savanna breeding program is to improve the maize farmer is well being. The objective of the program is to identify and/or develop high yielding and stable varieties adapted to varying agro-ecological zone and acceptable to farmers and agro-business.

In 1992, the lowland breeding unit has conducted 212 evaluation trials. Trials covered 40 ha distributed over 15 locations. The savanna program performed a total of 120 evaluation trials. Seventy nine of those trials were designed to evaluate introduced and newly developed varieties. 15 of the 120 trials were aimed at improving or developing maize populations. Finally 26 trials were set up for inbred/hybrids development. The forest zone program did 93 trials. 58 of these trials were designed to evaluating 929 genotypes. Only 3 trials were set up for population. Finally, 35 trials were aimed at inbred/hybrids development. In addition to this, the program used 15.1 ha for seed multiplication and varietal maintenance.

In general, 2% of the trials had their coefficient of variation (C.V) below 10%, 23% of the trial had C.V between 10% and 20%, 60% of the trials had the C.V between 20 and 30%, and finally 18% of the trial had their C.V higher than 30% and were therefore discarded.

Acid soil remains one of the major constraints in the forest area. In 1991, 9 varieties were introduced from Madagascar. Those unadapted varieties were crossed to some adapted inbred lines and tested in both acid soil and non acid soil. The selected varieties and their F_1 were selfed in 1992 along with the ATP varieties introduced from the mid-altitude zones.

From the heterotic pools, 7 new experimental varieties were formed in 1991. These varieties were advanced to F_2 and tested in 1992. In addition to this, S_1 or S_2 test crosses using the opposite pool or tester were initiated in 1992 for pool improvement.

In 1992, new three-way crosses were formed by crossing the F_1 obtained from 2 lines of different heterotic pattern with a third line of the third pools. The F_1 will be evaluated in 1993.

In 1991, selections were made for *striga* tolerance from material with different genetic background. Those selected lines were retested in 1992. Some *striga* Pools were made by recombining the retained lines. Those Pool were evaluated under artificial *striga* infestation. In addition 76 single crosses were produced and tested under artificial *striga* infestation.

In 1992, line development was continued for new trait donor sources and for hybrid or synthetic varieties development. On-farm trials for hybrids were started with the collaboration of the T.L.U.

In 1992, work on borers was intensified with the help of the entomologist. Finally, breeder seed maintenance and foundation seed multiplication were intensified as the demand was higher than in 1991.

CONSTRAINTS

1. Erratic rainfall
2. Poor soil fertility
3. Disease damage i.e. striga and streak virus
4. Insect damage i.e. termite at Maroua and Soucoundou
5. Soil erosion
6. Insufficient support staff
7. Untimely availability of input and research funds
8. No driver available for the unit
9. Poor relationship between researcher and administration.

2.2.2 SUMMARY OF PROGRAM ACTIVITIES

Activities carried during 1992 cropping season are presented in Tables 1 and 2.

Table 1. List of 1992 trials

I. Evaluation Trials

A preliminary yield

	Name of Trials	Number of trials		
		Entries	Savanna	Forest
1.	EVT NCRE	20	2	4
	EVT ESR	11	2	1
	EVT ISR	10	2	1
	EVT LSR-W	13	1	1
	EVT ISR-Y	9	1	1
2.	R.U.T Early (Drought)	15	3	0
	R.U.V.T extra early	10	3	0
3.	International hybrid-white	12	3	1
	International hybrid-yellow	8	2	1
	International striga open pollination	10	1	0
	International striga hybrid	10	1	0
4.	Pioneer trial	33	2	1
5.	AMUL 92 French trial	20	1	1
6.	Laposta x lowland (2 sets)	80	4	4
7.	New highland x lowland (4 sets)	308	8	4
8.	New tester single cross (2 sets)	65	4	2
9.	New three-way crosses	40	2	1
	Sub-total	674	41	22

Advanced yield trial

Name of trials	Number of trials		
	Entries	Savanna	Forest
10. N.V.T early	18	8	7
11. N.V.Y late	19	8	7
12. N.H.T	18	6	7
13. NCRE single crosses (2 sets)	37	8	8
14. NCRE yellow crosses	41	2	2
15. MIR single crosses	44	2	1
16. Advanced testers single crosses	37	2	2
17. Advanced highland x lowland	41	2	2
Sub-total	255	34	36
Total	929	79	56

II. Population improvement

Name of trials	Number of trials		
	Entries	Savanna	Forest
1. Open pollination x highland	36	2	2
2. Drought trial	42	4	0
3. Acid tolerant	33	-	1
4. Striga inbred advanced	40	2	0
5. Striga highland inbred	43	2	0
6. Striga Busseola inbred	46	2	0
7. Striga partial diallel	76	3	0
Sub-total	316	15	3

III. Inbred/hybrid development

	Entries	Savanna	Forest
1. TZB test-crosses			
- Group 1	140	4	4
- Group 2	90	3	3
- Group 3	70	2	2
2. TZB x TZUT	73	2	2
3. TZB tester single crosses	210	-	6
4. IITA TZUT x testcrosses	102	3	3
5. Selected crosses testcrosses	44	1	1
6. Crosses testcrosses	77	2	2
7. Suwan I testcrosses			
- Group 1	115	4	4
- Group 2	108	3	3
- Group 3	59	2	2
8. Suwan I tester single crosses	118	-	3
Sub-total	1324	26	35

IV. Seed multiplication and maintenance

Locations	Varieties	Land area
Bere	CMS 8704	2.0 ha
Sanguere	CMS 8704 (H.S)	0.5 ha
	Pop corn	0.1 ha
IRZV	CMS 8501 (H.S)	0.5 ha
	CMS 8501	2.0 ha
	CMS 9015 (H.S)	0.5 ha
	CMS 9015	0.5 ha
Soucoundou	CMS 8806	0.5 ha
Mayo Galke	TZPB SR	1.0 ha
Ndock	TZPB SR	1.0 ha
Touboro	TZPB SR	1.0 ha
Ntui	CMS 8704	3.0 ha
	CMS 8501	1.5 ha
	CMS 8806	1.0 ha

Table 2. 1992 locations used

Savanna locations	
Sanguere	4.5 ha
IRZV	5.0 ha
Maroua	2.5 ha
Soucoundou	1.5 ha
Bere	2.0 ha
Mayo Galke	2.0 ha
Ndock	1.5 ha
Touboro	2.0 ha
Agri-Lagdo	0.5 ha
Sub-total	21.5
Forest locations	
Yaounde	5.0 ha
Ntui	13.0 ha
Foumbot	1.5 ha
Yoke	2.0 ha
Ebolowa	1.0 ha
Sub-total	22.5 ha
TOTAL	44.0 ha

2.2.3 ACCOMPLISHMENTS

OBJECTIVES	ACTIVITIES	ACCOMPLISHMENTS
Operation 1: Testing of Introductions		
1.1. To identify new germplasm.	1.1 Variety trials on 2 to 4 locations.	1.1 About 20 introductions were tested.
1.2 To identify new trait donor source.	1.2 Inbred lines evaluation planted.	1.2 About 15 lines identified for tolerance to *striga*.
1.3 To collect data.	1.3 Data collections.	1.3 Data collected on all trials.
Operation 2: Population Improvement		
2.1 To improve plant and ear aspect, disease resistance, stress tolerance	2.1 Half-sib recurrent selection.	2.1 CMS 8501, CMS 9213, CMS 8806, CMS 8704 improved by half-sib
2.2 To develop new higher yielding and stable varieties.	2.2 S_3 recombination and variety crosses.	2.2 4 synthetics from TZB SR 4 synthetics from Suwan I made and advanced to F_2
2.3 To increase yield potential.	2.3 Same as 2.2	2.3 4 to 30% heterosis obtained in variety crosses.
2.4 To develop drought tolerant varieties.	2.4 Partial diallel among varieties from drought area.	2.4 40 F_1 obtained by diallel crosses.
2.5 Refinement of the 3 heterotic pools.	2.5 Reciprocal full-sib recurrent selection.	2.5 Full-sib families made between the three pools.

OBJECTIVES	ACTIVITIES	ACCOMPLISHMENTS
Operation 3: Inbred line development		
3.1 Creation of new heterotic and traits donors inbred lines.	3.1 Selfing, selection and evaluation on artificial environments.	3.1 Selfing and selection done on more than 14 populations.
3.2 Identification of new lines for heterotic pool improvement and variety crosses.	3.2 Combining ability studies and variety crosses.	3.2 Done on TZB, Suwan I and crosses population.
3.3 Development and selection of hybrids which are at least 20% better than the best open pollinated.	3.3 Single and three-way crosses formation and evaluation.	3.1 More 600 single and three-way crosses evaluated.
3.4 synthetic varieties development.	3.4 Diallel recombination among lines and advancement to F2.	3.2 9 new synthetic varieties developed.
3.5 Single cross and three way cross development.	3.5 Single crosses among lines from different heterotic groups.	3.3 About 200 single crosses and more than 1000 three-way and four way crosses made and evaluated.
Operation 4: Special Maize		
4.1 To create soft endosperm maize.	4.1 Backcross improvement.	4.1 Not done
4.2 To create variety adapted to intercropping.	4.2 Selection for erect leave and earliness.	4.2 2 erect-leaves pools created.
4.3 To create acid tolerant and drought tolerant pool.	4.3 Screening of lines under artificial environment.	4.3 Not done
4.4 Pop corn and sweet corn development.	4.4 Pop corn and sweet corn maintenance.	4.4 Seed maintained by random mating.

OBJECTIVES	ACTIVITIES	ACCOMPLISHMENTS
4.5 Maize for brewery.	4.5 QPM material	4.5 Not done
4.6 Maize for feed	4.6 Evaluation of QPM on chicken with IRZV.	4.6 Not done
Operation 5: National Varieties Trials		
5.1 To identify variety for release	5.1 Variety trials on 16 locations	5.1 CMS 9013 and 8321-18 x Exp_1 24 identified for yield potential
5.2 To collect data for program evaluation and scientific papers.	5.2 Same as 5.1	5.2 Data collected on all trials.
5.3 To test stability of new variety.	5.3 Same as 5.1 and across locations and years data analysis.	5.3 Not done
Operation 6:	**Multiplication and maintenance of breeder seed and foundation seed.**	
6.1 Production of better population.	6.1 Seed production in Half-sib.	6.1 Done on CMS 9031, CMS 8501, Ndock 8701, CMS 9015, CMS 8704.
6.2 Production of seed to supply agronomist, TLU and seed companies.	6.2 Seed production in isolated randomizing blocks.	6.2 Done on CMS 8501, CMS 8704, CMS 8806.
6.3 Population and lines maintenance.	6.3 Sibbing and chain-crosses of inbred lines.	6.3 Done on acid tolerant lines.

2.2.4 RESEARCH FINDINGS

Preliminary Yield Trial

Objective

To identify from introductions or from newly developed materials, higher yielding or trait donor source maize varieties which will be further evaluated in N.V.T (National Variety Trial) or used in population improvement.

Methods

In 1992 the 9 different types of preliminary yield trials included materials originated from IRA Cameroon, IITA, CIRAD, SAFGRAD and Pioneer. A maximum of three locations per zone were used for these type of trials. The number of entries ranged from 9 (E.V.T ISR) to 96 (New highland x lowland).

E.V.T NCRE

This trial was designed to evaluate newly developed pools and synthetic varieties as well as the high parent heterosis of some variety x testers crosses. Twenty entries were evaluated at 4 forest zone locations and 2 savanna sites.

In savanna, the Sanguere trial had the highest mean grain yield (5.4 t/ha). Grain yields obtained at Touboro were very low 3.3 t/ha. This was partially due to the low plant stand observed at this location (35000 plt/ha).

Across the 6 locations, Pool 2 (6.1 t/ha) was the best among the pools while synthetic 2 (6.7 t/ha) out yielded the 3 others. Synthetic 2 also yielded more than CMS-8501 (6.5 t/ha), Ndock 8701 (6.3 t/ha) and more than CMS 8710 (6.1 t/ha). This variety therefore will be tested in 1993 in N.V.T. At F_2 stage, all the high parent heterosis effect observed in 1991 among the F_1 variety crosses has disappeared.

AMUL 92 French trial

This trial originated from CIRAD-CA and was made of 20 hybrids from different sources. This trial was tested in 2 locations.

IR 1304 (6.9 t/ha) out yielded the other entries and had a 21% yield increase over the local check. 8321-18 x Exp 1-24 (5.7 t/ha). In general, 7 entries were better than the check. The previous best entry IR 30 (5.1 t/ha) and the IITA check 8644-31 (4.5 t/ha) yielded among the last. Most of these entries were susceptible to streak virus and they should be evaluated in *striga* infested field to know their potential in savanna zone.

Pioneer trial

This trial was also a collaborative trial between IRA and Pioneer. This trial was evaluated in 4 savanna environments. The objective was to identify high yielding and stable

hybrids that could be multiplied by Pioneer for progressive farmers. A second objective was to monitor the level of the lowland maize program.

The 33 entries of this trial were made of 8 Pioneer entries, 2 IITA hybrids, 21 NCRE hybrids and 2 open pollinated check. On *striga* free locations, YIE 78 (6.2 t/ha) out yielded the best NCRE entries 9071 x NCRE gp_2 8 (6.1 t/ha) by 100 kg. Among the top entries, there were 6 IRA entries and 4 Pioneer entries. Under artificial *striga* infestation, the most tolerant hybrid was 9021-18 from IITA, followed by 8321-18 x Exp 1-7. The most susceptible entry was the Pioneer 3274 with 7.2 rating out of9.

Laposta x lowland

This trial had 80 entries tested in two sets. Four locations were used in this evaluation. The objective was to select inbred line from laposta population with good combining ability that will be recombined and used as Tuxpeno tester in further testing. Results showed Exp 3-22 x lap 4 (8.1 t/ha) had a 25% yield increase over CMS 8501 (6.5 t/ha). Among the 7 selected hybrid, it was noticed that laposta materials crossed well with Exp 3 materials. Lap 4 and lap 3 appeared 5 out of 7 lines. Yields of 10.4 t/ha and 10.8 t/ha were obtained at Ntui for crosses of Exp 3-22 x lap 4 and Exp 3-18 x lap 4 respectively.

New highland x lowland

This trial comprised 308 entries tested in 4 sets. The entries consisted of new mid-altitude materials obtained from Bambui and IITA crossed to various lowland inbred.

Results revealed that in set 1, 87036 x NCRE gp_1 107 (8.4 t/ha) had a 40% yield increase over CMS 8501 (6.0 t/ha). All 6 selected had at least 20% yield increase over the best open pollinated check CMS-8501.

In set 2, TZMI 107 x 88069 (6.6 t/ha) which is a cross between IITA mid-altitude (TZMI 107) inbred and 88069 a Cameroon mid-altitude inbred line was the best over the 2 locations with 27% yield increase over CMS 8501 (5.2 t/ha).

In set 3, an 18% yield increase over CMS 8501 (5.1 t/ha) was obtained from NCRE gp_3 6 x HLM II 2 (6.0 t/ha).

In set 4, HLM I 13 x Exp 1-24 (7.2 t/ha) showed a 36% yield increase over CMS 8501 (5.3 t/ha). Among the 5 selected material Exp 1-24 was used as parent in 4 crosses. This indicated that all the HLM I are very heterotic to Exp 1-24.

EVT-LSR-W

This was a cooperative trial with IITA. The trial had 13 entries with 2 Cameroonian varieties (CMS 8710, Ndock 8701) and 1 Ghanian variety (OKOMASA). The evaluation was done in 3 locations. Results show that the hybrid 8321-18 x Exp 1-24 (7.8 t/ha) was the best followed by TZL comp 4 (7.7 t/ha). 11 varieties out of the 13 entries had yields superior to 7.0 t/ha. CMS 8710 and Ndock 8701 with 7.4 t/ha each yielded 0.4 t/ha less than the best entry.

International yellow hybrids

This was another cooperative trial with IITA. This trial tested 6 hybrids and 2 composites. The 3 best hybrids were 9848 x Cam I 17, 8644-32 and 8425-8 (RE) which yielded 6.5 t/ha over the 2 open pollinated.

Advanced yield trial

Objectives

1). To identify a high yielding stable variety, acceptable to farmer and agro-business for release, 2) to identify material to be included in National Variety Trials (N.V.T) or in National Hybrid Trial.

Methods

In 1992, the 8 different types of advanced yield trials were made of material which has been previously evaluated for at least 3 years. The most advanced one (N.V.T, N.H.T) were tested at all available locations and consisted of 4 rows/plot. Data obtained for those trials will be subjected to stability analysis in order to make a recommendation for release.

National variety trial late (N.V.T (l))

In 1992, 8 savanna environments were used for this trial. These were, Sanguere, Maroua, Soucoundou, Mayo Galke, Touboro, Ndock, IRZV (infested) and IRZV (non infested). The trial planted at Agri-lagdo had a poor germination and was therefore abandoned.

The 1992 N.V.T(L) had 19 varieties made of 9 open pollinated, 4 three way crosses, one single crosses, 3 F_2 variety crosses, 1 pioneer check and 1 IITA check. The design used was a RCBD with a 4 replications. The experimental unit consisted of 4 rows per plot. The objective of the trial was to identify a variety for release.

Results were obtained in 7 savanna sites. The four top entries were hybrids with average yields ranging from 5.6 t/ha for 8321-18 x Exp 3-10 to 5.3 t/ha for the IITA hybrid check 9021-18. CMS 8704 (5.0 t/ha) was the best open pollinated, followed by CMS 8501 (4.7 t/ha). When entries were evaluated under artificial *striga* infestation at IRZV 8321-18 x Exp 1-7 had the lowest *striga* symptom rating (3.8 out of 9) with an average of 6 *striga* plants per maize plant. However, 8321-18 x Exp 3-10 with 5.6 rating had the highest yield under infestation 3.0 t/ha. Average *striga* per maize plant for this variety was 8. No correlation was observed between the number of *striga* per plant, *striga* rating and yield.

Results were obtained in 5 forest locations. The five top yielding varieties were hybrids. The best one was 8321-18 x Exp 1-24 with 7.6 t/ha. The best open white pollinated varieties were CMS-8501, and CMS-8507 with 6.9 t/ha yield each. The best yellow entry was CMS- 8704 (6.8 t/ha). Suwan I W (CMS 9213) which was last years best entry had a very poor plant stand and was therefore discarded.

National variety trial early (N.V.T(e)

This trial tested 18 varieties made of 1 late drought tolerant (Tuxpeno sequia), 5 intermediate maturing varieties (100 days), 8 early varieties (90 days), 3 early drought tolerant varieties and 1 extra early variety (CSP = 82 days). This trial was also conducted in 8 savanna environments. The environments were the same as those used in testing the N.V.T(L). The design was a RCBD with 4 replications. The experimental unit was 4 rows/plot. All trials were planted at 70000 plants per hectare. Side-dressing was done 25 days after planting.

Results were obtained at the eight environments. Sanguere (7.9 t/ha) was the highest yielding location while Soucoundou (2.9 t/ha) showed the lowest yield. The low yield at Soucoundou was due to termite damage. Just like for the past 3 years, Across 87 Tzut-W (4.8 t/ha) was the best entry. It was followed by Tuxpeno sequia (4.7 t/ha) and CMS 8503 (4.7 t/ha). The best early yellow variety was an improvement of CMS 8802 (E.V 8731 SR) with 4.6 t/ha. TZE comp 3 x 4 (4.6 t/ha) was the best white entry. The 3 soft endosperm entries (BSR's) yielded poorly.

Under artificial *striga* infestation, Across 87 Tzut-W and Syn E_2 showed the lowest symptoms (4.5 rating). However, TZE comp 3 x 4 (3.9 t/ha) had the highest yield with 5.0 out of 9 symptom rating. Except for Mayo Galke (27.8%), all non infested trials had C.V. below 20%.

Results were obtained at 5 forest locations. Tzut-W (6.4 t/ha) out yielded the 17 other entries. This results are in agreement with the 3 past years results. Tzut-W is an intermediate maturing (100 days) variety very suitable for second season planting. The best early white variety was TZE comp 3 x 4 (5.9 t/ha). The best yellow early entry was CMS 8806 (5.7 t/ha). The extra early entry CSP yielded 3.4 t/ha.

National hybrid trial (N.H.T)

The objective of this trial was to identify a hybrid for release. The trial tested 18 varieties made of 1 open pollinated check CMS 8501, 1 IITA hybrid check (9021-18), 2 Pioneer checks (Yog 64, Yog 66), 11 three-way crosses and 3 single crosses. The experimental unit consisted of 4 rows/plot. The design used was a RCBD with 4 replications. This trial was planted at 4 normal sites and 2 sites artificially infested with *striga* seed.

The pertinent results are for the savanna zone. 8321-18 x Exp_1 7 (5.9 t/ha) had the best yield. This yield represented 28% increase over the O.P check, CMS-8501 (4.6 t/ha). It was followed by 8321-18 x Exp_1 24 (5.8 t/ha). This late entry was the best hybrid in 1991 and was used in 1992 in 15 on-farm variety trial. The 8321-18 x Exp_1 7 out yielded the IITA entry 9021-18 and the best Pioneer entry Yog 64 by 9%. Under artificial *striga* infestation 8321-18 x Exp_1 7 like in 1991 showed the lowest *striga* symptoms (4.4 out of 9). Pioneer yog 64 was very susceptible to *striga* (7.0 *striga* rating) 8321-18 x Exp_1 24 had the second best *striga* symptom rating. This entry also had the best yield under moderate *striga* infestation (3.7 t/ha), and was among the best under heavy *striga* infestation (2.0 t/ha).

Results obtained at 5 locations in the forest area showed that 9071 x NCRE gp_2 56-58 (7.8 t/ha) out yielded the other entries. This entry yielded more than 10 t/ha in Yaounde and Foumbot. However, yield increase over the best open pollinated CMS-8501 (7.3 t/ha) was only 0.5 t/ha which represented 7% superiority. 8321-18 x Exp_1 24 (7.5 t/ha) was third. This entry was the best in 1991. The *striga* tolerant yielded less than the best hybrid.

Advanced tester single crosses

The objective of this trial was to identify hybrids that will enter the N.H.T or N.V.T in 1993. The 37 entries consisted of single cross hybrids developed by crosses among IRA inbred lines from the three heterotic pools. The experimental unit was a 2 row/plot. Two savanna sites were used for this evaluation, Sanguere and Maroua. The trial at Maroua had heavy termite damages.

Results show that the single cross NCRE gp_2 11 x NCRE gp_3 59 (6.6 t/ha) had the highest yield. This represented a 32% yield increase over the best open pollinated CMS 8401 (5.0 t/ha). Five varieties out-yielded the O.P by at least 0.5 t/ha. These five varieties also out-yielded the pioneer check yog 64 (5.3 t/ha) by at least 5%. It was concluded that high yielding hybrids are obtainable among lines classified under different heterotic groups.

NCRE white single crosses

The total number of entries for this trial was 37. Those entries were therefore evaluated in two sets. These two sets were evaluated at 4 savanna locations. Each set consisted of 4 rows/plot tested in RCBD with 4 replications.

Results were obtained in 5 locations for set 1. The three-way cross check 8321-18 x Exp 1-24 (7.9 t/ha) and the IITA check 8321-18 (7.7 t/ha) out yielded all the single cross being evaluated. The best NCRE single cross was 1368 x NCRE gp_1 23-30 (7.6 t/ha). This cross was superior to the open pollinated check CMS 8501 (6.9 t/ha) by 10%. In savanna zone, results obtained at Maroua and Soucoundou showed C.V. superior to 35% and was therefore discarded.

Results were obtained in 6 locations for set 2. The three-way cross check 8321-18 x Exp 1-24 (7.0 t/ha) and the IITA check 8321-18 (6.9 t/ha) here again out yielded all single cross under evaluation. The best single cross was 1368 x NCRE gp_1 94-98 (6.6 t/ha). This cross was superior to the open pollinated check CMS 8501 (6.2 t/ha) by 8%. Data obtained in Maroua and Soucoundou were discarded due to high C.V. The unacceptable C.V resulted from heavy termite damage at these two sites.

Advanced highland x lowland crosses

Objective

To derive high yielding and stable hybrids from crosses between adapted highland inbred lines and lowland lines. The trial was also designed to identify high yielding crosses to be included in 1993 N.H.T or N.V.T(L).

This trial was evaluated at 2 savanna sites. Entries consisted of 34 single crosses, 1 IITA check, 1 Pioneer check (yog 64) and 1 open pollinated. The experimental unit consisted of a 2 row/plot. The design was a RCBD with 4 replications.

Two varieties HLM 5 x NCRE gp_2 8 (9.4 t/ha) and 8321-18 x Exp 1 24 (9.2 t/ha) yielded 23% more than the best open pollinated Ndock 8701 (7.5 t/ha). The highland inbred five (HLM 5) was involved in 4 crosses among the six best yielding hybrids. This line was identified as a good general combiner and will be extensively used in the future. The two best hybrids out yielded Pioneer yog 64 (7.7 t/ha) by at least 20%.

Single yellow crosses

The objective of this trial was to identify a yellow hybrid to be incorporated in 1993 N.V.T. This trial tested 44 entries made of material issued from yellow inbred testers crossed with NCRE inbred lines (cam I) of two different heterotic groups.

The experimental unit consisted of 2 rows/plot. The design used was a RCBD with 4 replications. Results showed that five single crosses out yielded the best open pollinated CMS-8704 (4.8 t/ha) by at least 17%. The best single cross was 9848 x Cam I gp_1 5 (6.0 t/ha). This hybrid out-yielded the hybrid check 8622-2 (5.4 t/ha) by 8%. Yield obtained at Maroua was very low and the C.V of the trial unacceptable. This was mainly due to termite damage at harvest.

III. Population improvement

Objectives

1) To improve grain yield and agronomic characteristics of existing varieties, 2) to develop new populations using traits donor source to meet a farmer specific requirement, 3) to improve heterotic effects of the 3 gene pool by reciprocal full-sib recurrent selection.

Open pollinated x highland

Objective

To improve the existing population by the addition of a complementary gene that would remain in the population after the F_2 generation.

Methods

This trial was made of 36 treatments. The experimental materials consisted of single crosses of 5 improved maize varieties with 8 highlands and lowland inbred lines. The crosses were made in design II fashion.

The experimental design was a 6 x 6 simple lattice with 4 replications. The experimental unit was a 4 row/plot.

Results showed that CMS-8710 x Tzmi 302 (6.2 t/ha) was the highest yielding F_1 cross with 19% high parent heterosis over CMS 8710 (5.2 t/ha).

The highest parent heterosis 35% was obtained in CMS-8501 x 5012 (5.8 t/ha). This was followed by CMS-8501 x Tzmi 107 (5.8 t/ha) with 32% high parent heterosis.These results suggested that, CMS-8501 and CMS-8507 could be improved by Tzmi 107, while Tzmi 302 could be added to CMS-8710. The F_2 cross Ndock 8701 x 9071 (5.7 t/ha) showed 19% heterosis over Ndock 8701 (4.8 t/ha).

Drought research

Objective

To develop drought tolerant and early varieties for Sudan savanna and/or Guinea savanna zone in late planting situation.

Methods

Nine varieties, introduced from drought areas of West Africa were crossed in partial diallel fashion. These varieties were, MAKA-SR from Mauritania, FBC6 from Burkina Faso, Tuxpeno sequia and laposta sequia from Cimmyt, BDP-SR from Cote d'Ivoire, CSP -SR and TZEE-W-SR from SAFGRAD, P_3 Kollo from Niger and CMS-9015 (Pool 16 DT) from Cameroon/SAFGRAD.

Results

The 42 F_1 along with 7 checks were evaluated in a 7 x 7 lattice at 4 environments. The pertinent data revealed that, the highest yielding crosses were Tuxpeno sequia x BDP-SR (5.1 t/ha), MAKA-SR x FBC6 (5.1 t/ha) and MAKA-SR x Tuxpeno sequia (5.1 t/ha). These crosses exhibited 16%, 13% and 12% high parent heterosis respectively. Among the 10 top F_1 MAKA-SR was involved in 5 crosses while Tuxpeno sequia appeared in 4 crosses. This data suggested MAKA-SR and Tuxpeno sequia were good combiners and that they belong to 2 different heterotic pools. Some of the entries will be recombined to form an early drought pool.

***Striga* research**

- research on *striga* tolerance involved 4 activities
- evaluation of inbred lines under artificial *striga*
- evaluation of single crosses made from crosses among selected inbred lines under artificial *striga* infestation
- pool formation under infestation
- evaluation of introduced open pollinated and hybrid under infestation.

Advanced *striga* screening inbred lines

Objective

To identify under artificial *striga* infestation, a tolerant inbred line that would served as parent in population development.

Methods

Experimental material consisted of 40 inbred lines selected in 1991 for their reaction to *striga*. These materials were planted in single rows of 6 m, with 1 m alley after the first 3 m. The first 3 m was infested with *striga* seed collected in 1991 and mixed with fine sand. 2 ratings on *striga* symptoms were done during the growing season. Ear aspect was also taken at harvest time. This represented visual ratings on ears for the infested(I) and non infested (NI) plot. The best rating was exhibited by lines showing less difference in ear aspect between the two treatments. *Striga* counts were made at 8, 10 and 12 weeks after planting. Data were taken in 4 replications.

Results

Data showed that among the white inbred lines evaluated, 7 lines had less than 5.0 rating for disease symptom. The best line was lap 3 which had 4.0 for rating with 4 *striga* per maize plant. 1368 exhibited the best ear aspect (2.3) while HLM 7 and NCRE gp_3 80 had the least *striga* plant per maize plant (2). HLM 3 scored 8.5 out 9, had the worse ear aspect (7.6) and had only one *striga* per maize plant. Among the yellow set, 65 inbred lines had less than 4.0 symptom rating, ear aspect and number of *striga* per maize plant.

These findings suggested no correlation between *striga* damage and *striga* per plant. However a non significant correlation was detected between ear aspect and *striga* per plant.

Striga partial diallel

Objectives

1) to determine the breeding value of lines selected under artificial infestation. 2) to determine if high yielding hybrids tolerant to *striga* are obtainable.

Methods

The trial consisted of 81 treatments. 76 of them were single crosses among lines selected in 1991 for their reaction to *striga*. The experimental units consisted of a single row plot of 6 m. The first 3 m were artificially infested with *striga* seed. The design used was a 9 x 9 lattice with 3 replications. A second trial (IRZV II) planted on naturally infested land had one single 5 m row as experimental unit. Rating for *striga* symptom was done at 10 and 12 weeks after planting.

Results

Yield and *striga* symptoms rating were recorded. Four single crosses rated less or the same as the IITA tolerant check 9021-18 (3.6). These lines were, Exp 1-42 x Exp 3-10 (2.5), 9030 x NCRE gp_1 107 (3.5), 8321-18 x Exp 1-7 (3.6) and NCRE gp_1 107 x Exp 1-7 (3.6).

Exp 1-42 x Exp 3-10 (4.1 t/ha) yielded at least 1.0 t/ha more than all the entries and showed a stable performance over the 3 environments. 8338-1 which is the IITA susceptible lines was the most susceptible with 6.5 average *striga* rating.

Among the 10 best hybrids based on rating Exp 1-7 appeared 7 times, NCRE gp_1 107 appeared 3 times, Exp 3-10 and Exp 1-42 appeared 2 times. This suggested their good combining ability for *striga* tolerance. However, it could be noticed that their performance per se were just medium when screened under artificial infestation. These findings suggested that, rating for *striga* symptom might not be the best selection criteria when breeding for *striga* tolerance.

Heterotic pools development

Objective

To improve the heterosis among the 3 already developed pools.

Methods

The 3 heterotic pools were planted during the second season of 1992. The plant density used was 25000 plants per hectare. This was done so that each plant could produce 2 ears. Pool 1 consisted of inbreds heterotic to Tuxpeno material. Pool 2 consisted of inbreds heterotic to temperate derived materials. Pool 3 was made of material heterotic to sub-tropical maize.

At flowering time, reciprocal plant to plant crosses were made between pool 1 and pool 2, pool 1 and pool 3, pool 2 and pool 3. The second ear of each plant was selfed. Seed from reciprocal plant to plant crosses will be mixed and tested in 1993. The selfed ears of selected crosses will be recombined during the second season to form the cycle 1 of those pools.

Inbred/hybrid development

Objectives

1. To develop good inbred lines that would served as new traits donor source
2. To develop good inbred lines that will be used in hybrid and/or synthetic varieties development
3. To test the combining ability of lines.

Methods

Nkolbisson breeding nursery is being used as the savanna program off-season breeding nursery. Three types of activities are being carried under the inbred/hybrid development sub program. These are

1. Inbred line development
2. Testcross development
3. Hybrid development

Inbred line development

Objective

To develop inbred lines with good agronomic characteristic and with good combining ability

Methods

Populations with different genetic backgrounds are selfed ear to row until the S_3 stage then testcrosses are made with an inbred line representing the 3 different heterotic pools. The inbred lines used for the time being are :

1368: derived from Cimmyt population 21 with Tuxpeno background
9071: which is N28 derived line with subtropical background.
5012: which derived from population 34 and have a sub-tropical background.

After S_4 stage, inbreeding of lines is done within heterotic groups until S_6.

Results

Sixteen (16) populations are under different stages of inbreeding. These populations are made of material of various genetic backgrounds.

TZB test crosses

Four groups of TZB material of different heterotic backgrounds were tested in 1992 as test crosses in order to further verify if those lines were correctly classified. Material used in each group were 1368 for group 1, 9071 for group 2, 5012 for group 3 and Tzut for group 4.

Group 1

This group had 120 testcrosses evaluated in 4 sets. 14 testcrosses were retained for 1993 evaluations. Yield ranged from 7.9 t/ha to 8.8 t/ha. The yield of the best hybrid check ranged from 7.9 t/ha to 8.7 t/ha while the best open pollinated check ranged from 7.0 t/ha to 8.1 t/ha

Group 2

This group tested 3 sets. 74 test crosses were evaluated. Grain yield means ranged from 6.6 t/ha to 8.1 t/ha. The best hybrid check ranged from 6.4 t/ha to 8.1 t/ha and the best open pollinated ranged from 5.8 t/ha to 7.1 t/ha. 9 lines were retained for further testing.

Group 3

This group tested 60 test crosses tested in 2 sets. Each set had 5 checks. 10 test crosses were retained for 1993 testing. Yield ranged from 7.7 t/ha to 10.1 t/ha. The best hybrid check ranged from 7.8 t/ha to 9.9 t/ha and the best open pollinated ranged from 7.1 t/ha to 8.9 t/ha.

Group 4

This group had 63 test crosses tested in 2 sets. 11 of them were selected with yields ranging from 7.3 t/ha to 8.1 t/ha. The best hybrid check ranged from 7.3 t/ha to 8.0 t/ha while the best open pollinated ranged from 6.7 t/ha to 7.1 t/ha.

Suwan I test crosses

239 suwan I inbred lines belonging to three heterotic groups were test crossed to their corresponding tester. Group I comprised materials heterotic to 9848, group II comprised inbred lines heterotic to 9450 which B75 converted, and group III comprised lines heterotic to 4001 which is derived from Cimmyt population 28.

Group 1 had 115 lines tested in four sets. 13 lines were retained for further testing in 1993. This represented 11% selection pressure. Grain yield mean of test crosses ranged from 8.1 t/ha to 8.9 t/ha. The hybrid check performances ranged from 8.2 t/ha to 8.7 t/ha. The open pollinated check CMS-8704 ranged from 6.8 t/ha to 7.7 t/ha.

Group 2 had 108 entries and was tested in three sets. 36 lines were selected out of the 93 lines evaluated. This represented a 39% selection pressure. Mean grain yields of test crosses ranged from 8.1 t/ha to 9.2 t/ha. The best open pollinated check CMS-8704 had mean grain yield ranging from 6.6 t/ha to 8.1 t/ha.

Group 3 comprised 59 entries and was tested in 2 sets. 6 lines were retained out of the 49 evaluated. This represented 12% selection pressure. Mean grain yields of test crosses ranged from 8.4 t/ha to 9.3 t/ha while the check ranged from 7.9 t/ha to 8.2 t/ha.

TZUT-W test crosses

34 Tzut inbred lines were crossed each to 3 inbred line testers. Those testers represented the 3 heterotic groups. The 102 F_1 crosses obtained were evaluated in 3 sets with 5 checks each. From the results 18 lines were selected for 1993 testing. This represented a 15% selection pressure. Mean grain yields ranged from 6.3 t/ha to 7.4 t/ha. The hybrid check Yog 64 ranged from 6.2 t/ha to 6.7 t/ha. CMS-8501 which was the best open pollinated check ranged from 5.3 t/ha to 5.8 t/ha.

Suwan I tester single crosses

This trial tested 118 entries evaluated in 3 sets. The experimental material was made of single crosses among suwan I inbred lines of different heterotic groups.

Results show the yield potential of the 19 selected entries was very high, ranging from 9.0 t/ha to 11.1 t/ha. Except for set 2, selected entries generally out yielded the best open pollinated by more than 1.0 t/ha.

FUTURE ACTIVITIES

1. Genetic study for *striga* inheritance (Thesis)
2. Development and improvement of a heterotic pool adapted to savanna and forest
3. Extensive tests (on-farm) of hybrid for release in 1994 to SODECOTON farmers
4. Initiation of low-input technology research
5. Training of a breeder.

CONCLUSION

The future looks bright considering the potential of good material in the pipe-line.

2.2.5 VISITORS

A total of 5 official visitors were received during 1992.

3. RICE PROGRAM

3.1 INTRODUCTION

The rice research unit has the mandate to improve on the quality of existing materials and select more improved lines resistant or tolerant to stresses based on each rice - growing ecology. The task therefore is to provide improved, high yielding and stable lines to the Cameroonian farmers together with improved agronomic techniques. Activities were performed following the 1992 plan of work.

3.2 SUMMARY OF PROGRAM ACTIVITIES

In Maroua, varietal comparisons of elite lines to the existing IR-46, rates of NPK (15-20-10), improvement of phosphate efficiency by the use of straw, and rates and frequency of phosphate application were the main trials conducted at Maga and Yagoua.

In Garoua, (Bokle and Lagdo), preliminary screening sets, observational nurseries for both fixed and segregating populations, replicated and advanced yield trials, seedling age of elite materials, rates and frequency of phosphate application, N x P interactions and seed multiplication were the main activities.

In Mbo and Ndop Plains the search for superior rice varieties continued in 1992. A total of 22 trials covering about 1.8 ha were conducted. These trials involved mainly selections from segregating genotypes from local crosses, screening of introduced fixed lines at an advanced stage of selection, production of pure seed from elite varieties and development of agronomic practices.

3.3 ACCOMPLISHMENTS

Objectives	Activities	Accomplishments
	Maroua/Garoua	
Operation 1: Varietal Improvement for High and Stable Yields in North and Far North Provinces.		
1.1. To identify useful germplasm for irrigated and rainfed conditions at various ecologies.	1.1 African Irrigated Rice Preliminary Screening set (AIRPSS).	1.1 Twenty entries were selected for yield trials.
	1.1.1 African Upland Rice Preliminary Screening Set (AURPSS)	1.1.1 A total of 21 entries were selected out of 150.

Objectives	Activities	Accomplishments
1.2 To assess the yielding ability of some agronomically suitable selections.	1.2 African Irrigated Rice Observational Nursery (AIRON).	1.2 Fourteen entries were selected for replicated yield trials.
	1.2.1 African Upland Rice Observational Nursery (AURON).	1.2.1 Nineteen entries were selected from 96 genotypes.
	1.2.2 Segregating population Observational Nursery (SPON).	1.2.2 Seventeen entries were selected.
	1.2.3 Fixed lines observational Nursery (FLON).	1.2.3 Twenty four of the lines were pre-selected for yield trials.
1.3 To compare the performance of some promising genotypes under lowland rainfed, upland and irrigated conditions.	1.3 African Irrigated Rice Advanced Trial (AIRAT).	1.3 Six genotypes were retained for further testing.
	1.3.1 Irrigated Lowland Observational Yield Trial (ILOYT).	1.3.1 Twelve genotypes were pre-selected for further testing.
	1.3.2 African Upland Rice Advanced Trial (AURAT).	1.3.2 Twenty five genotypes will be advanced to elite varietal trials.
	1.3.3 Replicated Yield Trial-Early (RYTM).	1.3.3 Will be repeated to confirm selections
	1.3.4 Replicated Yield Trial-Medium (RYTM),	1.3.4. Need to be reconfirmed.
	1.3.5 Rainfed Lowland Observation trial (RLOYT).	1.3.5 Seven out of 20 entries were preselected on bases of plant phenotype.

Objectives	Activities	Accomplishments
1.4 To compare the suitability and performance of some elite genotypes in large plots (irrigated, lowland and upland conditions).	1.4 Elite varietal trial in Yagoua/Maga	1.4 Most of the elite varieties yielded 6 t/ha and above notably ITA 212, IR 46, IR 35366.
1.5 To multiply breeder seed of some elite varieties by ecological zone.	1.5 Seed multiplication of elite line on plots above 1000 m^2	1.5 Elite varieties were multiplied on a total of about 1.5 ha in Lagdo and Bokle.
1.6 Assess acceptability of elite selections.	1.6 On-farm trials	1.6 Farmers prefered towards ITA 300 and IR 46.
Operation 2 : Cultural Practices and Soil Management		
2.1 Introduce a cropping sequence including the main cash crop (cotton) in rotation with rainfed rice.	2.1 Cotton - based cropping system with rice in lowlands alternating with rice.	2.1 A survey of farmers interested in cotton and rice was done. Over 85 farmers were identified in Bokle area.
2.2 To improve soil, water and cultural practices of rice and rice based land use systems for sustainable production in the lowland/flood plains of the Benoue Valley.	2.2 Management of rice straw and green manures as alternatives to applying high cost inorganic fertilizers.	2.2 Screening of green legumes in rainfed fields. Superimposed fertilizer levels plus use of rice straw in the form of compost. Rice straw in form of compost increased P availability to rice and reduced high rates of inorganic fertilizers.
	2.2.1 Soil test for standard P nutrient requirements.	2.2.1 Samples were collected but analyses not done.
	2.2.2 Determining optimum seeding rate of Crotalaria species as a supplementary source of N fertilizers.	2.2.2 Multiplication of Crotalaria in upland conditions.

Objectives	Activities	Accomplishments
	2.2.3 Rates and frequency of phosphate application in irrigated and rainfed rice.	2.2.3 Results of this experiment will be available in the report.
	2.2.4 N x P interaction on irrigated rice.	2.2.4 Conclusions cannot be drawn from results obtained. Needs to be repeated for at least two times.
	2.2.5 Seedling age of some elite varieties.	2.2.5 Preliminary results indicated that seedlings of 42 days still gave acceptable yield.
Operation 3. Reduce Post-harvest losses and Transformation of Broken Grain into forms acceptable to local consumers.		
3.1 Reduce post-harvest losses of existing varieties.	3.1 Determine a methodology of storing harvested rice prior to threshing.	3.1 Agri-Lagdo has had first year results. The trial will be repeated in 1993.
3.2 Technological transformation of rice and broken rice grains into consumable forms.	3.2 Determination of various uses of broken rice grains.	3.2 Some varieties were ground into flour and tried in the form of pap.
Operation 4. Preparation of Administrative and Financial Documents.		
4.1 To prepare and submit expense vouchers and coordinate Cereals Research activities.	4.1 Time sheet preparations.	4.1 Done bi-weekly or once a month.
	4.1.1 Write-up reports.	4.1.1 Semi-Annual report for NCRE, WARDA - Task Force reports.

Objectives	Activities	Accomplishments
	MBO/NDOP PLAINS	
Operation 1. Varietal improvement for High Stable Yields in Western Highlands and Mid-altitude regions of the West and North-West Provinces.		
1.1 Identify useful exotic germplasm in rainfed and irrigated conditions.	1.1 AIRPSS	1.1 Twenty seven entries were selected for further testing.
	1.1.1 AIRON	1.1.1 Twenty seven entries were selected for observation Yield Trials. (OYT).
	1.1.2 AIRAT	1.1.2 Five out of 18 entries were selected for further testing
1.2 Assess the yielding ability of some agronomically suitable selections from previous years.	1.2 OYT	1.2 Out of 120 entries tested in Mbo Plain, 20 were selected for further testing. In Ndop Plain, out of the 61 entries none was superior to the local check.
	1.2.1 Preliminary Yield Trial (PYT) and Advanced Yield Trial (RYT).	1.2.1 Out of 12 irrigated lines in PYT, none were selected. Four out of 12 AYT lines were retained for further testing.
1.3 Confirm adaptability and suitability of elite lines.	1.3 National Coordinated varietal Trial (NCVT).	1.3 IR 7167-33-2-3 widely recommended in Ndop outyielded all test entries in 1992.

Objectives	Activities	Accomplishments
Operation 2. Screen Germplasm of Local and Exotic Sources for Release as Varieties or as donors in Hybridization Program and Select Head Lines from Segregating Populations.		
2.1 Development of newly created local lines.	2.1 Segregating population.	2.1 Out of 168 F_5/F_6 upland lines, 35 were selected for further testing in OYT in Mbo Plain. In Ndop Plain 40 were selected out of 155.
2.2 Seed production.	2.2 Breeders' seed production (head row selection).	2.2 Ten varieties in Mbo Plain and seventeen in Ndop were used to produce head rows after purification.
Operation 3. Screen Germplasm from International Institutes for Regional Constraints.		
3.1 Screen varieties adapted to low temperatures.	3.1 OYT of previous selections.	3.1 Five out of 10 cold tolerant entries were selected for yield testing.
3.2 Screen varieties for tolerance to blast.	3.2 International Rice Blast Nursery (IRBN).	3.2 Six out of 160 entries were selected for OYT.
	3.2.1 Selection of fixed population.	3.2.1 Twelve entries out of 50 from WARDA leaf and Neck Blast (LNBN) were selected and 14 out of 60 were also selected from the Leaf and Panicle Blast Nursery (PLBN) for testing in 1993 OYT.
3.3 Screening varieties for yield and stress.	3.3 Special yield and stress trial (SYST).	3.3 Twenty out of 100 lines screened for yield, drought, blast and plant type showed satisfactory performance.

3.4 RESEARCH FINDINGS

Reported findings are limited to major activities that are almost concluded. Details of all the results will be published in the Rice Research Annual Report (RRAR) for 1992. Findings are reported for activities carried out in Maga/Yagoua in Maroua, Bokle/Lagdo in Garoua and Mbo and Ndop Plains in Dschang.

Methodology

The methodology adopted during 1992 is similar to practices of the previous years. Observational nurseries were established on 2.5 m to 5 m long single plots with varying planting distances depending on location. However plant spacing ranged from 12.5 cm to 25 cm in the row and 20 to 25 cm between rows across locations. All replicated trials were conducted in randomized complete block design (RCBD) with at least 3 replications and at most 4 replications. For rainfed and Upland trials, seeds were drilled in field plots directly as is the case in Mbo Plain and dibbled in Bokle. Seed rate at both locations was about 70 kgs/ha. For irrigated trials, seeds were raised on wet bed nurseries and transplanted 21 to 25 days after seeding at a seed rate of about 100 kgs/ha. Observations for each location are stress specific (disease, cold, drought etc...) and are recorded based on the International Rice Research Institute's (IRRI's) standard evaluation system for rice (1980). For the Agronomic experiments, details of the methodology are available in protocols. However most trials were laid out in a randomized complete block design or split plot.

At harvest, two border rows were removed along four sides of the yield plots. For observational nurseries, grain yield is expressed in grams per plot and in replicated yield trials grain yield is expressed in kilograms per hectare at 14% moisture content. Similarly, grain yield for the agronomic trials was expressed in kilograms per hectare. Other yield related parameters such as plant height, tiller and panicle count per square meter were also recorded.

Results

Selections from the preliminary Screening Set and observational nurseries, will be advanced to yield trials across locations.

For the Advanced Trials and Replicated Yield Trials, genotypes with high grain yield, good phenotype and tolerance/resistance to major environmental stresses were selected for researcher managed elite varietal trials. Selections may be nominated for certain desirable traits and proposed for crossing to the International Network for Genetic Evaluation of Rice (INGER) - Africa or the West African Rice Development Association (WARDA) in Bouake (Ivory coast).

Irrigated Trials (Varietal Improvement)

AIRPSS

Out of 150 entries, 20 were selected (table 20) based on major stresses and phenotypic acceptability in Lagdo. Similar criteria were used in other locations in the country.

Similarly, across locations, selected genotypes were screened for major stresses and advanced to yield trials (table 2).

AIRAT

Twenty varieties were screened in Lagdo. Most entries had acceptable yields. However, 17 of the entries outyielded the current local check (ITA 300). In a varietal yield trial at Mbo Plain, most entries outyielded the local check (Tables 4 & 5). In an advanced yield trial in Ndop, 2 varieties performed better than the local check IR 7167-33-2-3 (Table 6).

Elite Varietal Trial

In an elite varietal trial at Yagoua, ITA 212 appeared to outyield the local check IR 46 but the difference was not statisticallly significant. Most varieties had yields above 6 tons/ha (table 7).

Breeders' Seed production and Multiplication

In Lagdo and Bokle the rice unit multiplied seeds of 7 elite varieties on 1 ha. A total of 400 kg of seeds was produced for future distribution to interested farmers, notably CICA 8, CISADANE, ITA 212, ITA 222, ITA 300, BKN 7033-3-3-2-2-3, and IR 46. In Mbo Plain, CICA 8 and Cisadane were multiplied on about 1000 m^2 to supply pure foundation seeds for parastatals. Seventeen other promising varieties were multiplied for preservation. One hundred panicles were selected from each of the seventeen varieties for a Go lot. Breeder's Seeds will be produced from the following varieties : Cisadane, ITA 222, Cica 8, Tox 3142-1-1-1-3-1, Tox 3118-47-1-1-5-3, BKN 7033-3-3-2-2-3, B 4140C-PN-186-28, ITA 306, UPR 254-85-1-TCA-3, and BG400-1.

Upland/Lowland Rainfed Trials

In Bokle some promising entries were identified from AURAT (Table 8), replicated yield trial early and medium (table 9) and some of these varieties will be tested in our elite upland varieties trial.

Seed Multiplication

ITA 257 and IRAT 112 performed well in upland conditions in Bokle. These varieties were put in for multiplication during the off season.

Rice Agronomy

Most results obtained are still preliminary. In the Bokle area a variety is yet to be identified for agronomic trials. Results of conducted trials will be included in the Rice Research annual report.

Table 1 : Number of Entries and selections of Upland Rice Trials in 1992 Wet Season.

NURSERY	NUMBER OF ENTRIES	NUMBER OF SELECTIONS	LOCATION
AURPSS	150	21	Bokle (Garoua)
AURON	96	19	Bokle (Garoua)
AURAT	16	5	Bokle (Garoua)
SPON	100	17	Bokle (Garoua)
FLON	100	24	Bokle (Garoua)
RYTE	9	Need to be repeated	Bokle (Garoua)
RYT-M	9	Need to be repeated	Bokle (Garoua)
LROYT	20		Bokle (Garoua)
LPBN	60	14	Mbo Plain
LNBSN	50	12	Mbo Plain
SYTS	100	20	Mbo Plain
ARBN	160	6	Mbo Plain

Table 2 : Entries and Selections of Irrigated Rice Trials and their Locations

NURSERY TRIAL	NUMBER OF ENTRIES	NUMBER OF SELECTIONS	LOCATION
AIRPSS	150	20	Lagdo
AIRON	100	14	Lagdo
AIRAT	100	6	Lagdo
ILOYT	20	-	Lagdo
Rate and frequency of Phosphate application.	10	-	Lagdo/Maga
N x P Interaction	15	-	Lagdo
Seedling age of elite Lines	16 combinations	-	Lagdo

Table 3 : Performance of Genotypes from the Airat at Lagdo 1992 Wet Season

GENOTYPE	MATURITY (DAYS)	PLANT HEIGHT (CM)	DISEASE SCORE (BLAST)	GRAIN YIELD (KGS/HA)
C 1321-9	126	88.9	0	7427 A
S818B-10-2	126	98.5	0	6603 ABC
IR 68	126	117.6	0	6295 BCD
IR 21820-154-3-2-2-3	126	101.8	0	5633 BCDE
IR 28118-138-2-3	126	105.4	0	5439 BCDE
ECIA 36-2-2-1-4	126	93.0	0	5423 BCDE
ITA 312	126	96.3	0	5323 BCDE
TOX 3344-TOC-3-4	126	125.1	0	5388 BCDE
AT 77-1	126	114.3	0	5375 BCDE
TOX 3145-TOC-34-2-3	126	118.9	0	5215 BCDE
IR 28128-45-3-3-2	126	102.5	0	5184 BCDE
IR 19660-46-1-3-2-2	126	105.5	0	5179 BCDE
IR 1834-36-3-3	126	98.9	0	5167 CDE
B 3894-22C-78-5	126	104.3	0	5104 CDE
TOX 3145-TOC-15-2-1	126	111.0	0	4990 CDE
BR 316-15-4-4-1	126	111.5	0	4907 CDE
IR 50404-57-2-2-3	99	87.8	0	4779 DE
ITA 300 (CHECK)	126	99.4	0	4491 DE
IR 65	126	94.9	0	4403 DE
B 2983 B-SR-85-3-2-4	108	126.6	0	4245 E
L.S.D (.05)				1432.9
CV (%)				16.6

Means followed by the same letter are not significantly different.

Table 4 : Performance of the top ten entries and check variety in V.Y.T-E conducted under irrigated conditions at Mbo plain 1992 first season.

Entry	Grain Yield (Kg/ha)	50% flower (days)	Reaction to (0-9)**				
			Leaf blast	Neck spot	Brown scald	Leaf type	Grain
Tox714-1-204-1-102-1	5694	103	1	3	1	5	L
Tox3133-59-5-4	5513,6	101	2	3	1	5	L
BW 348-1	5169,8	100	1	5	1	5	M
IR 19392-115-3	4916	96	2	3	1	5	L
ITA304	4824	99	3	5	1	5	L
ITA 302	4802	100	1	3	1	5	L
ITA 212	4735	105	2	5	1	5	L
IR35311-25-2-1-3	4626,8	92	2	5	1	5	L
IR22082-41-2	4520,5	99	1	5	1	5	L
Tox 1835-11-1	4384	104	3	3	1	5	L
CICA8 (L.C)*	3704	98	3	7	1	5	L
Mean of 10 entries	(4918,6)						
L.S.D. (5%)	966						
C.V. (%)	13.08						

* Check variety

** Scoring according to the standard evaluation system of rice IRRI 1988.

Table 5 : Performance of the 12 entries and check variety in V.Y.T-M conducted under irrigated conditions at Mbo plain 1992 first season.

Entry	Grain Yield (Kg/ha)	Plant height (an)	Reaction to (0-9)**				
			50% Flower (days)	Leaf blast	Neck blast	Sheath rot	Glume Disc
ITA 216	5453	100	2	3	1	5	L
IR 28128-45-3-3-2	5390	113	2	5	1	5	L
ITA 239	5348,5	116	1	3	1	5	L
ITA 302	5310	102	2	5	1	5	L
B4140C PN-186-23-KP_2	5283,8	105	1	5	1	5	ML
IR 2042-178-1-	5099	106	4	5	1	5	L
Tox 981-10-3-2	5060	104	3	5	1	5	L
B 3988E-PN-164-6	4881	102	3	5	1	5	M
SEBERANG	4862,6	106	3	3	1	5	L
CISADANE	4715	110	5	5	1	5	L
Tox 3118-47-1-1-5-3	4282	124	2	5	1	5	L
ITA 222 (L.C)*	416	102	5	7	1	5	L

Mean of 12 entries: (4582)
L.S.D. (5%) 1136
C.V (5%) 14.80

* Check entry.
** Scoring according to the standard evaluation system of rice IRRI 1988. DISC: Discoloration.

Table 6 : Performance of entries in medium duration advanced yield trial conducted under irrigated conditions at Ndop plain during 1992 wet Season.

Entry	Grain Yield (Kg/ha)	Plant height (an)	Reaction to (0-9)**				
			50% Flower (days)	Leaf blast	Neck blast	Sheath rot	Glume Disc
IR715.579-135-3	4895	98	124	1	1	1	1
Tox 3145-34-3-3-1	4731	81	131	2	3	1	1
Tox 3145-34-3-3	4558	80	131	2	3	3	3
Tox 3145-15-2-1	4514	71	132	2	3	3	1
Tox 3145-34-3-2	4499	84	133	2	3	1	1
Tox 3145-34-3-3-2	4460	74	132	2	3	3	5
B298 838.SR.51-1-2-3	4338	95	128	2	3	3	3
Tox 3145-38-2-3	4307	67	137	2	3	3	3
IR7167-33-2-3 *	4241	82	124	3	3	3	3
B2881F SR-62-5	4076	75	130	3	5	5	3
B2161-cm-57-1-3-1	3977	93	129	2	3	3	5
IR 2061-522-6-9	3833	96	129	2	5	3	3

Mean of 18 entries (4010.75)
L.S.D. (5%) 469
C.V. (%) 12.6
* Check variety
** Scoring based on the IRRI standard evaluation System for Rice 1988.

Table 7 : Performance of some 13 elite varieties in yaqoua 1992 wet season.

Varieties	Cycle (Days)	Height (cm)	Panicles/m^2	Grain Yield Kg/ha
ITA 212	150	82.5	528	8.1 A
IR 46	153	84.3	513	7.8 AB
IR 35366	151	83.3	508	7.5 ABC
S 818B	154	85.3	509	7.3 BCD
S 3894B-40D	149	84.0	503	7.2 BCD
S 499B		82.3	501	7.0 CDE
IR 64	148	82.5	500	7.0 CDE
IR 42028-22	152	82.0	471	6.8 DEF
IR 15847	153	85.5	470	6.8 DEF
IR 4595	158	83.3	471	6.7 EF
DR 33-PD5-RD2	152	82.5	473	6.6 EF
AD 9246	154	81.0	458	6.5 EF
IR 4219-22-1-1-2	150	81.5	431	6.4 F
Means of 13	148	83.0	482	7.1
L.S.D(.05)	3	2.1	31	0.6
CV (%)	14	1.8	14.4	13.8

Table 8: Performance of upland varieties from the advanced yield trial in bokle - 1992 wet season.

GENOTYPE	MATURITY (DAYS)	PLANT HEIGHT (CM)	DISEASE SCORE (BLAST)	GRAIN YIELD (KGS/HA)
TOX 10 10-21-5-12-4	108	126.5	1	3923 A
IRAT 314 (7441)	108	118.3	1	3706 AB
TOX 1011-4-A2	108	119.3	1	3522 ABC
TGR78	123	136.3	1	3056 BCD
IDSA27 (IRAT 306)	108	121.0	2	3056 BCD
WABIS560	123	171.8	1	2928 BCD
IDSA13 (IRAT 265)	108	126.5	1	2884 CD
WABIS675	123	150.8	0	2820 CD
TOX 1739-101-4-2	123	141.3	0	2761 CD
ITA 143	123	137.3	0	2695 D
ITA 132	123	135.3	1	2680 D
TGR 94	123	150.5	0	2675 D
ITA 130	123	143.8	0	2662 D
WABIS 844	123	148.8	0	2652 D
IR 46 (LOCAL CHECK)	123	86.7	7	2394 D
ITA 335 (TOX 189-3-102-1-1-2)	123	142.0	1	2430 D
L.S.D (.05)				408.9
CV (%)				19.6

Means followed by the same letter are not significantly different.

Table 9 : PERFORMANCE OF EARLY DURATION RICE GENOTYPES IN BOKLE 1992 WET SEASON

GENOTYPE	MATURITY (DAYS)	PLANT HEIGHT (CM)	DISEASE SCORE (BLAST) (0-9)	GRAIN YIELD (KGS/HA)	
IDSA 10	114	118	3	5534	A
WAB 56 104	100	123	2	4938	AB
ITA 257	114	107	2	4793	AB
WABC 165	114	146	2	4123	AB
WAB 56 - 50	114	126	2	4083	B
WAB 56 - 57	114	128	2	4044	B
WAB 56 - 125	100	123	2	4028	B
IAC 164	100	136	2	3883	B
IR 46 (CHECK)	114	94	7	1715	C
$L.S.D_{(.05)}$				1415	
CV (%)				23.5	

Average of 4 replications. Means followed by the same letter are not significantly different.

Table 10 : Performance of medium duration rice genotype in bokle - 1992 wet season.

GENOTYPE	MATURITY (DAYS)	PLANT HEIGHT (CM)	DISEASE SCORE (BLAST)	GRAIN YIELD (KGS/HA)	
ITA 321	131	134	1	5327	A
ITA 333	131	150	1	4870	AB
ITA 331	131	136	1	4194	BC
ITA 325	131	125	2	4110	BC
ITA 335	131	141	1	3782	CD
IDSA 6	131	121	0	3649	CD
ITA 301	131	128	0	3636	CD
CNA 4143	131	151	0	2990	DE
IR 46 (CHECK)	131	85	6	2296	E
$L.S.D_{(.05)}$				976.5	
CV (%)				17.3	

Average of 4 replications. Means followed by the same letter are not significantly different.

Conclusion

ITA 300 has become the main variety in Lagdo. Over 70% of the farmers in Lagdo now cultivate ITA 300 as against BKN 7033-3-3-2-2-3, that had been released earlier. IRAT 112 remains a variety highly requested by farmers growing upland/rainfed rice in the Benoue valley. ITA 257 is highly valued as a short to medium duration rainfed variety. In Ndop Plain, and Menchum Valley Tox 3344-34-3-2 is highly appreciated due to its grain quality. However IR 7167-33-2-3 remains the highest yielder in Ndop Plain.

3.5 VISITORS

The Rice Program was honoured to receive Drs. Eugene Terry (Director General of WARDA), and Peter Matlon (Director of Research WARDA). Both dignitaries visited from 21/09/1992 to 24/09/1992 and were able to observe research fields in Bokle, Lagdo and Mbo Plain. Other visitors included the Integrated Pest Management Task Force Team (IPMTF) of WARDA and others.

4. CEREALS AGRONOMY

4.1 INTRODUCTION

This unit has as primary responsibility to conduct agronomic research on maize in the three Provinces of North Cameroon, and on sorghum in the North Province. Since its creation in 1982, this Unit has devoted 70% of its research efforts to maize agronomy and 30% on sorghum agronomy. In Northern Cameroon, (6 -13° latitude North, around 160 000 km^2), the maize area under traditional and intensive cultivation is estimated to be around 70,000 ha while the total area under sorghum production is estimated to be around 430,000 ha.

The main objectives of this Research Program are to a) identify and alleviate the main agroclimatic and management constraints to cereals production in the major growing zones of the mandated area of Northern Cameroon, b) develop improved and adapted packages of agronomic technologies for maize and sorghum and for sustainable cereals-based cropping systems and c) participate in the extension of improved technologies to the farmers of the region in cooperation with development and extension agencies.

We use an adaptive research program oriented towards production and development. During the last 10 years the researchers of this unit conducted more that 400 field trials at 8 different IRA/North antennas and on farmers' fields on maize and sorghum agronomy. A lot of progress regarding several research subjects has been accomplished. We have prepared several production guides on these subjects. Many varieties and agronomic practices have been extended to the farmers in the region in cooperation with the development and extension agencies. During NCRE phase III, we have intensified our agronomic research on sustainable agriculture and the development of appropriate practical conservation farming technologies and *Striga* control on maize and sorghum-based cropping systems, particularly in the lowland sub-humid savanna.

4.2 SUMMARY OF PROGRAM ACTIVITIES

During the year 1992, the unit research team has been involved in many technical activities. It helped organize in January 1992 at IRA/Garoua a 3-day workshop on laboratory methods for the determination of *Striga* seeds in soil samples and in vitro study of *Striga*. A group of 8 IRA researchers and technicians participated in this workshop sponsored by IITA Maize research Program. We presented and discussed our annual report at the research meeting of IRA/North which was held at IRA Garoua in February 1992. We helped organize a short course related to computer use, maintenance, use of software: SYSTAT, Harvard graphics, Wordperfect 5.1 and lotus 1-2-3. The training activity which was held at IRA/Garoua in March 1992 was organized by the NCRE Project and the IRA Biometry Section. We were actively involved in the organization of the 4th IITA/COMBS Workshop held at IRA/Garoua from 30 August to 4 September, 1992 A total of 40 researchers from 8 countries attended this regional workshop. As local coordinators we devoted a considerable amount of time and energy for preparing this workshop. We organized 5 field training day for researchers, extension and farmers. Emphasis was put on legume - based technologies and conservation farming technologies.