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Attachment B

REPORT TO:
USAID/Y, AID/W
and GRUC

TA 80-1

North Cameroon Seed Multiplication

Project - Analysis and Recommendations

For Phase II

BEST AVAILABLE DOCUMENT

Services Rendered

Under The Cooperative Agreement

Between

AID/W and MSU

AID/DSAN-CA-0148

SEED TECHNOLOGY LABORATORY
MISSISSIPPI STATE UNIVERSITY
MISSISSIPPI STATE, MISSISSIPPI

REPORT TO:

USAID/Y, AID/W and GRUC

on

North Cameroon Seed Multiplication Project - Analysis and Recommendations for Phase II

Services Rendered
Under the Contract
Between
AID/W and MSU
Contact AID/DSAN-CA-0148

SEED TECHNOLOGY LABORATORY
Mississippi State University
Mississippi State, MS 39762

February, 1980

Report Summary

TITLE: North Cameroon Seed Multiplication Project - Analysis and Recommendations for Phase II

CONTRACT: AID/DSAN-CA-0148 with Mississippi State University

CONSULTANTS: Mr. Gary A. Reusche, Mr. James M. Beck and Dr. Charles E. Vaughan; Seed Technology Laboratory, MAFES, Mississippi State, MS. 39762.

PERIOD OF CONSULTATION: January 10-25 (Vaughan)
January 10-31 (Beck)
January 10 - Feb. 7 (Reusche)

Summary

1. The Mississippi State team suports the need of establishing viable foundation seed farms to do the first multiplication(s) of breeder seed.

Breeder seed must be multiplied under strictly controlled conditions to maintain varietal purity and provide seed of good quality. Without this process, varietal improvement at the research station will never make an impact on the small farmer.

Crop improvement programs and seed production are two distinct operations. Strong linkages must be developed between IRA (DGRST) and the Foundation Seed Program. These linkages must be practical (i.e., IRA would supply limited quantities of breeder seed) and adequately funded. IRA should be encouraged to recruit a peanut specialist. As a general comment, the IRA breeder's talents should be focused on breeding and not seed production. It is enough that he maintain good breeder seed. Further, most breeders are seldom both good breeders and good seed producers.

Finally, experiences in North Cameroon and elsewhere indicate to the Miss. State team that contract seed multiplication by the small farmer of Foundation Seed may present serious problems.

2. The seed program must be scaled to developing manpower resources. The initial project in the opinion of the Miss. State team was overly ambitious with respect to the availability of skilled, knowledgeable manpower. This apparent over-extension of the project staff resulted in an extremely weak quality control element in the production, processing and distribution of the seed. The resulting poor seed quality and seed "degeneration" was commented on by both seed project staff and seed recipients to be major problems.

3. Manpower resource development must be accorded high priority to further train personnel. This can be divided into two areas of priority:

1. Seed Technology

2. Agricultural Machinery

4. Foundation Seed Production on State operated farms (en regie) should be confined to the Sanguere and Guetale farms as a first step. Early seed program developments must be concentrated. Diffusion of efforts, fragmentation of resources, and dispersion of operations are not ways to build a program. Inital efforts and available resources must be concentrated, centrally managed and closely coordinated until the program attains the "critical mass" stage and becomes self sustaining.* Only then can the program be broadened rapidly in an orderly, efficient, and successful manner.

The available acreage at the Sanguere and Guetale farms, already cleared and suitable for mechanization, are more than adequate to supply the identified foundation seed needs for the Centre-Nord Project.

5. Support must be expanded at the two foundation seed farms in relation to the quantities of seeds that need to be produced, processed and distributed.

If a foundation seed program is built with makeshift, piecemeal and haphazard inputs then its outputs are unlikely to be different. This is especially true when the seed crop is peanuts. The problems encountered in peanut production, quality control, processing and storage, are among the most difficult of any seed crop.

6. A realistic time-frame must be established. It appears to the Miss. State team that part of the quality control problems encountered in the first phase of the project were due to trying to do <u>too much</u>, <u>too fast</u>, with <u>too little</u>. The "crash program" approach to building a seed program has not been successful. Ample time for development must be allotted.

7. The seed project must provide technical expertise to the different organizations receiving the foundation seed, and educate the rural sector to the benefits of using good seeds of improved varieties.

The activities of seed <u>production</u> at the small farm level, a major activity of the seeds project during the last 4 years, must cease and be redirected to information dissemination. Seed production <u>per se</u> at the small farm level is the responsibility of the extension oriented agencies.

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* This is not meant to refer to economic self-sufficiency.

8. Planning, evaluation and implementation must be a continuous process. Lessons can be gained from the first experience and will generate the momentum necessary to re-orient the project towards an efficient and successful operation. The dangers of the impending "interim period" cannot be over-emphasized. Effort must be made by the government and funding agencies to not only sustain the project, but also to invigorate it.

In the future, a continuous planning, execution and implementation process may best be assured by the creation of a coordinating organization, such as a national seeds committee, which would have more control over the decision-making concerning seeds. There appears to be no reason why the national seed service could not be incorporated into the present implementing agency for the seed project (MIDEVIV).

In conclusion, it appears to the Miss. State team:

a. that the projected Centre-Nord Project presents a good outlet for the foundation seeds.

b. that IRA is capable of supplying breeder seed to the project if some basic agreements are established and a payment is made for the services rendered.*

c. that no attempt needs to be made initially to establish a certified seed program. This is a logical step only after the development of viable foundation seed farms and there is an increased awareness of improved seed as a contributing element to an overall production program. It can be added as the need, resources, and manpower become available.

d. that the seed project staff is a dynamic group capable of implementing such a project if a viable organization is established and technical assistance is made available.

e. that a technically feasible program is possible at this time.

f. that the seed project will be under great pressure to supply foundation seed to the Centre-Nord Project in 1981 or 1982 and thereafter.

g. that the present seed stocks of the project are of unknown quality and questionable pedigree.

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* It is noted that IRA represents the weakest link in the chain if viable foundation seed farms are established. Ideally, the multiplication system achieves maximum effectiveness when seeds of superior adapted varieties are used. But, it is also effective when unimproved varieties are processed through the system, for merely cleaning and treating the seed, and providing seed of good quality, can be expected to increase its value by 10-15% over grain held by subsistence farmers as seed.

ACKNOWLEDGEMENTS

The authors appreciate the assistance of the USAID staff, especially Mr. Gary Bittner, and the other members of the Rural Development office headed by Mr. Eric Witt and Richard Goldman.

In addition the authors are grateful to Mr. Konga of the Studies and Project office of MINAGRI, and his staff, in particular Mr. Emmanuel Toze who accompanied the team to the North as the representative of the Ministry.

Further, the authors recognize, appreciate, and thank the personnel of the present North Cameroon Seed Multiplication Project and the National staff of MIDEVIV, whithout whose excellent cooperation this document could not have been prepared.

The the FAO representative, we wish the greatest success in the elaboration of a national seeds policy during the next year and hope that we will have the opportunity to deepen the working relations between us.

Charles E. Vaughan
Gary A. Reusche
James M. Beck

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Report To

USAID/Y, AID/W and GRUC

on

North Cameroon Seed Multiplication Project -
Analysis and Recommendations for Phase II

1.0 INTRODUCTION

1.1 Terms of Reference

The USAID/Y and AID/W requested and the Project Officer approved an approximately four-week assignment for two seed program development specialists and a seed processing engineer. The assignment was to analyze in cooperation with the appropriate departments of the Ministry of Agriculture and interested quasi-autonomous agricultural development societies (i.e., SEMRY, MIDEVIV, SODECOTON) the existing North Cameroon Seed Project and present from this analysis several options such as an expanded seed program in the Northern Province. In addition, linkages were to be investigated between the North Cameroon Seed Project and the national level (MIDEVIV) presumably leading to recommendations and the possible creation of a National Seeds Service. This later goal of the assignment being focused upon conjointly by the GURC, USAID and FAO and the object of further detailed analysis during the next year by a newly arrived FAO seeds specialist and other experts of the GURC and USAID. Finally, the MSU team completed a 3-day training seminar on various aspects of seed technology.

The seminar was a valuable source of information to the team as it grouped the entire seed project delivery system thereby providing valuable input about the level of technology understood and implemented by the project and its impact on the small farmer.

2.0 CURRENT SITUATION AND BACKGROUND INFORMATION

2.1 Rainfall and Relative Humidities*

The northern province of Cameroon extends from about seven degrees to 13 degrees north latitude and includes two of the traditional eco-climatic types in Africa; the Sudanian and the Sahelian types. Rainfall decreases from south to north and there is a pronounced dry season from November through April throughout the entire region. Average annual

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* Extracts from the Resource Inventory of North Cameroon prepared by USDA/FAC in 1977 and "L'Atlas du Cameroon" prepared by the Cameroonian Institute of Scientific Research.

rainfall is presented in Table 1 for 3 stations:

Table 1. Rainfall Data

Station	CAMEROON ECO-CLIMATE CLASSIFICATION	AVERAGE ANNUAL RAINFALL (m m)
Maroua	Sudan-Sahelian	804
Garoua	Sudanian	982
Mokolo	Sudanian highlands	961

Relative humidity variations during the day, an important factor in seed drying and storage, are presented for the Maroua station in Table 2. It can be noted that during the month of harvest (September), the relative humidity is high. Beginning in November, relative humidities remain below 50% during the 24 hour period, and this condition persists until the month of May.

The division between the major eco-climatic zones occurs about midway between Maroua and Garoua. A major sub-group of the Sudanian zone, the Sudanian highlands is found west and south-west of Maroua in the region bordering Nigeria.

A 1968 census of the region showed a population of approximately 1.3 million. Generally, the area surrounding Maroua extending east and west to the borders of Chad and Nigeria respectively is the most densely populated. The population is increasing at an annual rate of 1.2 percent.

2.2 The North Cameroon Seed Multiplication Project. Summary of Activities (1976-1980) and Perspectives for the Future.*

The Seed Project started with the Agreement signed on June 15, 1976 between the United States Agency for International Development (USAID) and the Government of the United Republic of Cameroon, with a view to

* This section is translated from the document "Rapport de Synthese des Activites du Projet Semencier et Perspectives d'Avenir," prepared by the NCSP staff. It is considered to be an accurate documentation of the status and problems of the seed project during the period of consultation.

Table 2. Average Variations in Relative Humidity During the Day at the Maroua Station from 1956-1968.

	Time of Day and relative humidity			
	2400	0600	1200	1800
January	33	34	15	23
February	25	27	12	15
March	23	23	12	16
April	43	47	18	26
May	62	67	33	45
June	82	91	51	62
July	89	90	60	76
August	85	94	68	85
September	95	95	62	84
October	85	82	38	63
November	51	50	22	36
December	39	40	18	28

meeting the needs for improved seeds. The expected increase of yield would result in an increase of the farmers' income and a reduction of consumer prices.

Four cultural seasons have passed since the effective beginning of the project activities. The project has two objectives: (1) the development of a regional network for the multiplication and distribution of seeds, and (2) the production of high yielding and adapted seeds to meet the needs of 250,000 farmers growing 430,000 ha of sorghum and 100,000 farmers growing 73,000 ha of peanuts.

During the first cultural season (1976/1977) centered on the Dadjamka center, the Seed Project, in conjunction with IRAF-NORD cultivated 31 ha of seeds; that is, 3 ha of sorghum and 28 ha of peanuts. The resulting production (37 T of peanuts and 10 T of sorghum) was used to start the programming of the 1977/78 season.

The second season (1977/78) showed a considerable extension of the project activities by the opening of two new seed multiplication centers in Guetale and Sanguere. A total of 225 ha of seed fields were cultivated, among which 205 ha were planted in peanuts and 20 ha in sorghum. The expansion of the Seed Project occured outside the centers with the beginning of seed multiplication by contract farmers. The total production of both project and farmers fields reached about 400 T of peanuts and 30 T of sorghum. The seeds obtained from this season enabled a considerable extension of the activities during the subsequent season.

The experience gained during the previous seasons allowed the Seed Project to launch a large-scale program during the 1978/79 season. Therefore, 410 ha of peanuts, sorghum and maize were cultivated in the various seed centers in the following proportions: 353 ha of peanuts, 52 ha of sorghum and 5.5 ha of maize. The farmers under contract with the Seed Project planted 1,278 ha (1,245 ha of peanuts, 33 ha of sorghum) in conjunction with SODECOTON, Nord-Est Benoue Division, the YFFTC and the D.D.A.'s

In spite of the abundant rainfall, that season was extremely bad all over the province due to the attacks by aphids, the lateness of sowing, and the bad distribution of rainfall characterized by periods of drought. The average yields were under 0.5 T/ha.

The 1979/80 season presents a special character as it marks the end of the first phase of the Seed Project. The results have been satisfactory even though it did not reach the desired levels. However, 413 ha of peanuts have been planted in the centers (349 ha of peanuts, 53 ha of sorghum and 11 ha of maize). The production and yield are being evaluated; they will be higher than last year. The number of contract farmers has been reduced and they have been better supervised. Table 3 summarizes the results obtained by the Seed Project over its four years of life.

Table 3.*		Peanuts		Sorghum		Maize	
		Area(ha)	Prod.(T)	Area(ha)	Prod.(T)	Area(ha)	Prod.(T)
1976/77	S.P.	28	37	3	10	-	-
	F.	-	-	-	-	-	-
1977/78	S.P.	285	250	20	30	-	-
	F.	94.5	150	-	-	-	-
1978/79	S.P.	353	93.74	52	52	5.5	5.5
	F.	1245	375	33	33	-	-
1979/80	S.P.	349	200	53	53	11	13
	F.	390	195	120	-	-	-

* The figures for the 1979/80 season are estimated.

S.P. = Seed Project Farms and F. = Farmers.

This table shows the evolution of the planted areas in the seed centers. However, the yields remain rather modest. These low yields per ha. are due to:

(a) The lack of foundation seeds. In fact, IRAF-NORD does not have the means or the qualified personnel for the production of foundation seeds. Two attempts were made to import breeder seeds from Senegal, but they were not successful.

(b) The qualitative and quantitative inadequacy of the working conditions which result in a mediocre quality of the produce and the excessive use of labor resulting in the very high cost of production.

(c) The adverse weather conditions. Even the rainfall over one year is adequate, its distribution and intensity are sometimes pernicious.

(d) The inadequacy of the cultural techniques which result in soil depletion. The rotation systems are not yet well assimilated. The soil is neither protected nor restored.

(e) The under-utilization of chemicals (fertilizers and pesticides).

Concurrently with the seed production component, the training component started in 1977. Four Cameroonian agronomists have been trained in the US. Seminars, either at the regional (Central Africa) level or the local (Northern Province) level, are held regularly as well as in service training for field workers.

Moreover, 4 US technicians are based in Maroua and Garoua. The supply of commodities by the US partners is going on.

Initially, the Seed Project was to be implemented over 5 years. But, due to the fact that the funds are exhausted, AID has reduced the project life by one year, thus bringing the PACD to September 1980. Within 11 months of the departure of US technicians, several issues remain to be solved:

Have the objectives been achieved? This question is difficult to be answered either in the affirmative or the negative. First, it should be noted that, if the objectives stated in the agreement of June 1976 were rather ambitious, the means to be utilized to achieve them were not clearly defined. One of the basic errors have been to assign to the project a triple role of seed production, dissemination and marketing. It should also be noted that it is impossible, over a period of five years, to train personnel, to develop an efficient system of seed production and prosessing, especially when adequate means are not established from the beginning.

Presently, the Seed Project can be considered as a study and experiment unit which will be the base of a subsequent activity. It pointed out the existence of a real need of the population, and it was able to make an inventory of the problems which are to be faced in the development of a seed production system. Its particular value is to have set the foundation for the National Seed Service which will come into being during the Five Year Plan.

The second question relates to the dead end in front of which the Seed Project will be at the departure of the US technicians and before the beginning of the National Seed Service. This problem is especially important as all the basic problems met in the implementation of the Seed Project have not been solved. For example, the Seed Project does not yet have the weeding, harvesting and processing equipment. As far as processing is concerned, it is a very important point and constitutes a bottleneck to the Seed Project. In addition, the seed warehouses are still under construction. Prior to the departure of the US technicians, a plan of action should be defined for the transitional period, and the government should be kept informed of the modifications to the initial agreement.

In conclusion, the implementation of the Seed Project indicates the awareness by the decision makers of the fondamental role of high quality

seeds in agricultural production. Only high quality seed can produce a good crop.

In spite of the many difficulties the Project has had to face, it is essential that the experience be continued and expanded to other provinces because its operations are necessary for the strengthening of our agriculture.

2.3 Goals and Funding of the NCSP*

The overall goal of the project was to increase productivity of the land in small farms, thus improving farm family incomes and reducing the price of cereal foods. The Mission for the Development of Food Crops (MIDEVIV) was given the responsibility of establishing a regional seeds office in Maroua which would coordinate the production and distribution of improved peanut and sorghum seed. Technical personnel were to be recruited and trained to carry out these goals. The target population and production goals are presented on page 4.

Overall funding originally scheduled for the project was to be obtained from USAID and the Goverment of Cameroon (GRUC) along the usual lines of AID financed projects. GRUC was to provide in-country facilities, personnel and support costs, and USAID would provide technical assistance, materials, and training. Five year costs were originally scheduled to be:

GRUC	-	$ 773,000 (U.S. equivalent)
USAID	-	$ 1,549,000
Total		$ 2,322,000

However, as the project progressed and serious budgetary constraints became apparent in attempting to achieve the ambitious goals of the project, yearly funding levels increased and the result can be summarized as follows. The USAID contribution originally schedule for five years will be exhausted in September of this year (1980) thereby ending the USAID contribution at 4 years. AID funding and two technical experts will leave the project at that time which is not well accepted in the eyes of the Cameroonian officials who feel "cheated" out of one year.

On the other hand, after a slow start, the GRUC contribution grew from approximately $50,000 in year 1 to approximately $900,000-$1 million per year in project years 3 and 4. If the upcoming budget is approved as expected the GRUC contribution during the life of the project will reach approximately $600 million CFA francs or $3 million U.S. dollars. Trucks, cars, tractors and other investiments have been purchased through these additional funds - not to mention the increased local support and personnel costs - which were justified only by the concerted drive of

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* North Cameroon Seed Multiplication Project.

the GRUC to attain the ambitious goals set by USAID as part of the grant agreement.

These facts revealed to the Miss. State team the extraordinary effort and serious committment of the GRUC to create a viable supply of improved seed to the small farmer in North Cameroon. The experiences of the team members in other countries in West and Central Africa have rarely been of this nature. Government contributions are often on the order of 25%, calculated on the basis of salaries, land and other costs. In the case of the NCSP it may attain 65% of the total project expenditures. The committment to the project by the GRUC is clear. So is the fact that the project is in serious financial and technical difficulties as will be detailed in this report - resulting in no small measure to the strict adherence to an ambitious and technically incomplete project design which should have been scaled down in the 4th project year after the mid-point evaluation.*

2.4 Mission for the Development of Food Crops, Vegetable Crops and Fruit Trees in Areas Surrounding Urban Centers.

The Mission for the Development of Food Crops (MIDEVIV) was created in 1973 as a quasi-autonomous agricultural development society under the control ("sous tutelle") of the Ministry of Agriculture. It is presently in its sixth fiscal year of operations (June 79-June 80). In this respect MIDEVIV is conceived and operated in the same manner as several other organizations in North Cameroon in contact with the NCSP (i.e., the Cotton Development Corporation - SODECOTON, or the Rice Production "Perimetre" - SEMRY).

The charter for a development society is approved by an interministerial body which grants the society the right to enter into the defined areas of specialization. In the case of MIDEVIV, according to the Activity Report of Fiscal Year 1978/79, the activities are in three major categories: (1) Production Centers, (2) Marketing, and (3) Studies. The production centers concentrate on the production of improved plant material and is therefore where the NCSP fits in. The marketing activities are concentrated in the Center-South Province (Yaounde), with some activities in the eastern and Northern Provinces. The principle crops marketed are rice, plantain, "Abbia", "Diamaor", Palm Oil, Sugar and "Haricots". Marketing of cereals is handled by a Cereals Office and not MIDEVIV. A major study was presented in the report concerning the creation of a "Green Areas" in the Yaounde region where intensive production of food crops would be developed to supply the growing demand in Yaounde.

A brief outline of the decision-making process of MIDEVIV is appropriate to understand the advantages and/or disadvantages of such a

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* This issue is further developed on page 11.

system. MIDEVIV is responsible to the Ministry to Agriculture (MINAGRI) for its activities both at the national and local levels. Each year a Report of Activities is prepared, along with a proposal for the activities to be undertaken the upcoming year. This proposal is presented to an Administrative Council.

The Administrative Council is composed of 9 members representing various Ministries and administrative levels.* The Director of Agriculture (MINAGRI) generally serves as Chairman (See Figure 1). The decision taken on the proposal is then passed on to the Minister of Agriculture.

All along this process the Department of Studies and Projects (MINAGRI) will analyze the proposal and advise the Minister (MINAGRI) of MIDEVIV's performance in the past and the technical viability of the proposal.

Once this process is terminated, and the program of activities including the budget is approved, MIDEVIV has complete autonomy to execute the program including budgetary control. MINAGRI at that time is responsible only to be assured that the program is executed as it was approved. In the case of the NCSP, this means that the Provincial Delegate, who is the representative of the Minister (MINAGRI), is responsible to follow the activities of the project and advise the Minister of its status.

The administrative relationship between MIDEVIV/Yaounde and the NCSP is direct; that is, the regional MIDEVIV offices in the North do not play a role. In essence, the relationship between the NCSP and MIDEVIV/ Yaounde are analogous to those between MIDEVIV/Yaounde and the Administrative Council.

In the opinion of the Miss. State team, this procedure that has been developed through trial and error over the last few years, is completely adequate to insure that timely decisions are taken at the field level. Nearly all NCSP expenditures will be controlled in Maroua by the project director, according to recent decisions taken by MIDEVIV, on the basis of detailed activitity and budgetary plans prepared annually by the NCSP.

It is noted that problems did occur in the past due to various factors. At one time a Seeds Project Management Committee acted as an "Administrative Council" at the Provincial level. It was composed of the ministerial representatives of MINAGRI and MINEP, the director of

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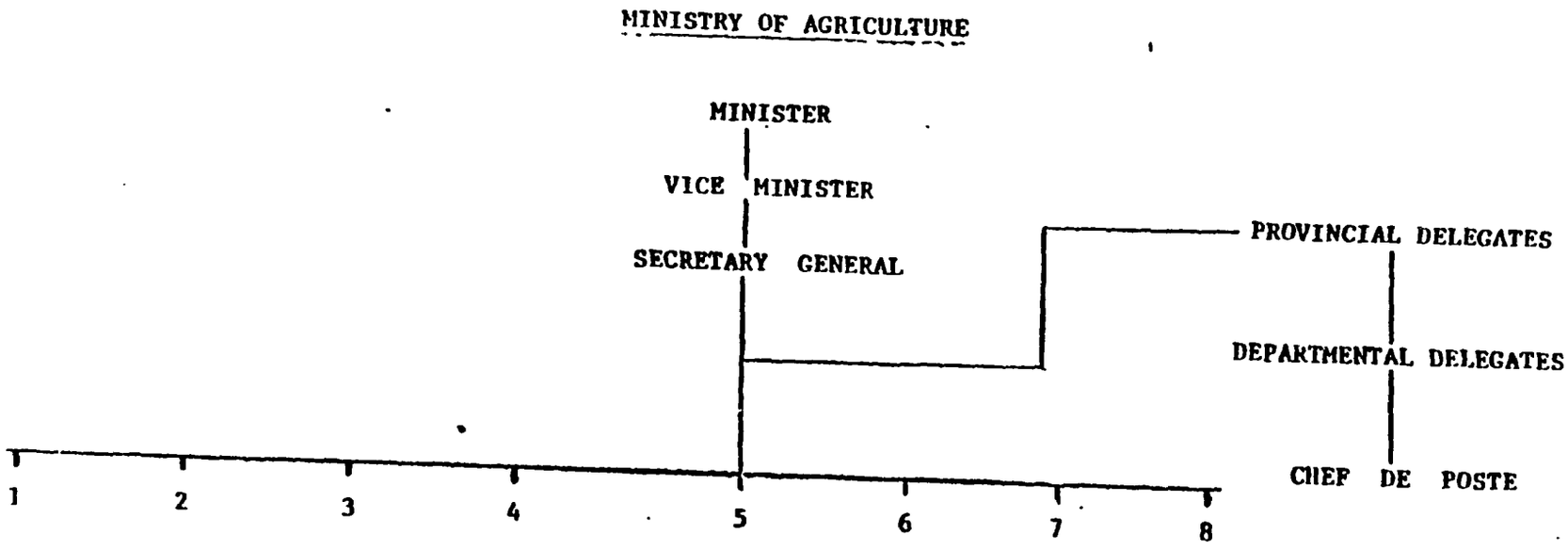
* Three from MINAGRI, two from the Ministry of Economy and Plan (MINEP), one from the Ministry of Finance, one from the Presidency, one from the Credit Organization (Fonader) and the Governor of the Center-South Province.

Figure 1.



1. AGRICULTURE
2. STUDIES AND PROJECTS
3. WATER RESOURCES, FORESTRY AND WILDLIFE
4. AGRICULTURAL EDUCATION
5. GENERAL ADMINISTRATION
6. COOPERATION AND MUTUALITY
7. COMMUNITY DEVELOPMENT
8. RURAL ENGINEERING AND AG HYDRAULICS

MIDEVIV, the director of the NCSP and USAID. This was annuled by the Minister of Agriculture because it was not necessary.

Finally, it must be pointed out that MIDEVIV is presently the object of a study at this time by the government which may result in a change in the original charter. Also, the question is asked, if a National Seed Service is created, is MIDEVIV the organization to which it would be attached. In this respect, it is significant that the FAO seeds expert will work closely with MIDEVIV and his office is to be established in the National MIDEVIV headquarters.

2.5 Review and Comments Mid-Point Evaluation

The NCSP was evaluated in the Fall of 1978 by two consultants engaged by Development Alternatives, Inc. It is relevant to note that one had an "economic botany degree" and the other was an economist. Both men had considerable expertise in their fields but it is important to note that neither were seed specialists *per se* or agronomists by training. This is important to indicate for two reasons. First, the document places a great deal of emphasis on the economic benefits that would be expected from the use of improved seed, the need to supply inputs, better organization of project extension actjvities - in short, the areas where their expertise was greatest. The second reason is that a seed technologist would have looked more at the details relating to "seed". The upshot is that seed quality is not mentioned in the document. Quality control was not listed as a recommendation. This was, indeed, a serious omission.

No attempt will be made to summarize the document; it is well written, accurate and the issues presented are as valid in 1980 as when it was written. The issues and problems raised have not been dealt with beyond a discussion level; the major goals of the project remained unchanged despite recommendations to do so.

Since the evaluation, one additional cultural season has transpired and in the surge of energy by a dedicated staff to push ahead with a program scaled far beyond the resources available. The result was a cursory quality control program and in effect a peanut production project (in contrast with a peanut *seed* project).

2.6 IRA(F) - North

IRA-NORTH* (or IRAF-North) is one of four major centers within a national administrative framework coordinated by the General Delegation

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* Agriculture and Forestry Research Institute. It appears that Forestry is being reorganized outside of the framework of IRAF. The general analysis of IRAF is extracted from the document "National Cereals Research", USAID Bureau for Africa (1979), personnel interviews with the Director of IRAF-North, and various organizations who have working relations with IRAF-North.

for Scientific and Technical Research (DGRST) formally known as ONAREST. the DGRST reports to the Ministry of Economic Affairs and Planning. "IRAF in general is a rather loose conglomeration with relatively little internal coordination. It faces a large number of agro-ecological conditions and must do research on a very large number of crops. Often its flexibility is reduced by tight budgets and delayed central government allocation."

"IRAF uses a system of budgeting by program. In it, the research work is divided into programs. The system has problems caused by overlapping end-uses. In addition, funds are only made available on an annual basis. Budgetary allocations may cease before completion of a research activity."

It is noted that a major effort is underway to strengthen IRA. The National Cereals and Research Project (funding approximately $7.7 million), the Regional Food Crop Protection Project, the SAFGRAD project, the CRSP for Grain sorghum/Pearl Millet*, and other donor agencies participate in the institutional development of IRA. At this time a SAFGRAD researcher is stationed at IRAF-North and has completed one year of variety trials.

IRA-North has its main research station at Guiring. Guiring is located six kilometers outside of Maroua, and the farm has approximately 50 hectares available for research. A request has been made to increase the size of the farm to 100 hectares but due to its proximity to Maroua, this has not met with success. The station has two completed warehouses and a garage for the maintenance of farm machinery. Electricity is not available.

One warehouse at Guiring is nearly complete that was destined for storing seed produced at the seed farm. For the last year or more, because of reputed problems with the building contractor, the warehouse sits as a monument of a job not completed and bogged down in bureaucracy. This warehouse is located at IRA-North and this site decision coincided with an interest by IRA-North to multiply seed (hence, the reason why additional land was requested at Guiring).

Other branch stations of minor importance are Sanguere, Soucoundou, Kalfou and Badjouma. IRA-North's major research interests are cotton, millet and sorghum, rice, corn, cowpeas, okra and peanuts. In 1978 IRA-North had a professional staff of eight Cameroonians and six expatriates. Of the GURC professional staff, four worked with cotton, one worked with forestry, one specialized in soils, and two specialized in cereal crops (production and protection of rice, corn, millet and sorghum).

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* Mississippi State University is one of the participating 8 universities.

Finally, in the town of Maroua, IRA-North is apparently endowed with adequate office and support facilities. Its infrastructure occupies the "quartiers" of Djarensol (16 hectares of field trials and nine hectares of an office/residential compound) and Domayo (13 hectares in an office/ residential compound).

A number of working meetings were held with IRA, in some cases with the seeds project staff participating in a "round-table" discussion. The Miss. State team had been told a number of times that of two major constraints, the supply of breeder seed constituted one. The analysis of this constraint during the course of our interviews resulted in the following observations.

Obviously a seeds program is built on the supply of "breeder seed" which results from many years of testing and genetic improvement by specialized agronomists (plant breeders). Just as obvious, without a viable multiplication scheme of the breeder seed, the breeder is working in a vacuum and the "fruits" of his work will neither have an impact on production nor encourage him to respond to the needs of the farmer. The logic of this linkage is obvious, but in practice in a developing system it becomes confused. That is, the breeder talks about seed multiplication, and the seed project talks of varietal improvement.

Crop improvement programs and seed production are two distinct operations. Each requires specialization; one is dependent on the other. The search for better varieties and the improvement of existing varieties has for its goal the identification of superior, adapted varieties that are destined for release to the farmer. However, the varieties produced by research are of very limited quantity - maybe only a couple of kilograms. "To have significant effect, this small amount of 'breeder' seed needs to be multiplied many times...in such a way as to maintain the genetic purity of the seed." If the multiplications are haphazard and without proper control, the delivery system breaks down - the research is useless to society.

Concerning the constraint of breeder seed, the team investigated the linkages between the NCSP and IRA-North. It was noted that the origin of the seeds multiplied by the project in 1976 was indeed IRAF and the seed provided was universally aclaimed to be a superior, adapted variety sought by the small farmer. However, since that first delivery of seed, IRA-North did not continue to do so.

The year IRAF supplied seeds to the NCSP, a contract had been signed and funds provided to render the service in the contract. IRAF* states that to maintain varietal purity, breeder seed must be supplied

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* Compte Rendu de l'Execution de la Convention No. 148/SG/BE/75/76. IRAF.

each year to the NCSP. It was indicated that funds must be made available to permit IRAF to execute this service. The team is of the impression that with financing, IRA-North could have provided this service. However, the agreement was never renewed after 1976.

On the negative side, there is no peanut specialist on the staff of IRA-Nord, and in fact peanut research in the country is almost non-existent.* This is an intolerable basis for a major peanut seed program.

In essence, the upshot is meant to be that well defined linkages were never developed between IRAF-North and the NCSP. The first contract in 1976 was due mainly to the fact that the NCSP financing was not available, and the staff not settled in and therefore IRAF took charge of the 1976 multiplication (i.e., Seed Project Year 1). The constraints of IRAF have already been indicated and because of these constraints other projects in the North regularly negotiate agreements with IRAF for services to be rendered. An example of such a document between SEMRY and ONAREST for specified services of the IRAF station has been reviewed and is on file in the USAID/Y office. The team discussed this point with the SEMRY technical leader and he indicated his complete satisfaction for the last 2 years.

IRA-North's actual research activities which are centrally funded from ONAREST are summarized in Table 4.** Out of 32 different research projects listed in the document, 23 or 72% concerned cotton, and cotton research funding was approximately 50% of the total.

In addition to the activities listed in Table 4, it is understood that specialized agreements are customary between IRA-North and the agency requesting such service, and funding is made available. This was discussed in relation to SEMRY. Finally, it is understood that IRAF-North maintains 30 varieties of peanuts on the station and 474 varieities of sorghum.

It is essential that IRAF-North be given the means to supply breeder seed to the NCSP and of course this includes the addition of technical expertise where there are gaps. It is estimated that in the case of peanuts, IRAF-North would need to supply approximately 2-3 metric tons of breeder seed <u>each year</u> to satisfy the needs of the NCSP. If an agreement is spelled out to this effect and funded, this constraint can be overcome in the eyes of the Miss. State team for the immediate future. However, this statement is conditional on the immediate recruitment of a peanut breeder, who represents a vital link in the seed program.

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* Only two varietal maintenance programs are indicated in IRAF's research summary for 1979-80.

** From IRAF documents "Programes de Recherches/1979-80" and "Rapport de Synthese/1977-78" and personnel interviews with Mr. Benzi-Tsala.

Table 4. Current Research Programs at IRAF-North with Central Funding in Fiscal Year 1979-1980.

TITLE	RESEARCHERS	FUNDING
1. Millet and sorghum variety trials.	Djambong/Bindzi	2,650
2. Sorghum selection in segregation populations after radiation-induced mutation.	Djambong/Bindzi	2,240
3. Sorghum and millet varietal collection	Djambong/Bindzi	1,500
4. Adaption of Muskwari sorghum to wet season planting.	Bindzi/Djambong	1,660
5. Sorghum seed multiplication	Bindzi/Djambong	2,350
6. Pedalogic study of 10 soil profiles.	Bindzi	500
7. Soil chemistry/ parent material.	Bindzi	500
8. Soil chemistry/physical and chemical properties of parent material.	Bindzi	500
9-23 Various studies on cotton.	Nguyen, Lancereaus, Lacaille, Jacquemard	12,309

2.7 Technical Observations

a. The basic supply of breeder seed to the seed multiplication project is not operable, nor assured in the future.

b. The efforts of the seed project staff to date cannot be underestimated. Valuable experience has been gained, basic infrastructure established, and administrative channels worked out.

c. Lack of equipment to produce, and condition peanut seed is real and limiting.

d. Maintenance of production and conditioning equipment is fragmented and dependant on the limited facilities of IRA-North and CENEMMA. No provisions were noted to maintain equipment on either seed farm.

e. A conflict of opinion exists between the use of contract seed growers or modern production centers for the multiplication of seed. During the course of the interviews, and in the general analysis of the Miss. State team, it appeared clear that contract seed multiplication by the small farmer presents serious problems resulting in varietal degradation and poor seed quality. Not only do the experiences of the NCSP seem to indicate that after the first year seed was produced at the small farm level the resulting seed was considered of undesirable quality (to the point that some seed utilizers refused to pay for it), but also the rice seed production at the SEMRY project reinforced the conclusion that small farmer seed production has inherent problems.

The SEMRY project produces improved rice seed for approximately 5,000 hectares. As it is an irrigation project, the geographical area is therefore limited and the project extension service and seed production are likewise restricted to the irrigated area. In effect it could be regarded as a well-structured, financially endowed microcosm of the agricultural sector of North Cameroon.

The original concept of seed production at SEMRY was to choose various farmers in different locations to produce the required seed. It was found that the technical control using this system was inadequate. This next year, SEMRY is going to re-group the best farmers in a seed production unit of 60 hectares - a "seed farm" - under the strict control of the project agronomist.

Many ideas were brought up as to why seed "degraded" so fast at the small farm level and a few will be mentioned here to reinforce the upshot.

First, if the contract farmers are going to be paid more for their harvest, this must be associated with strict quality control. If not, the farmer will be tempted to include his local varieties

and poor quality seeds in order to take full advantage of the inflated price. Or, in seed production, there is an elimination of "off-types" that is necessary to assure varietal purity but from the small farmers viewpoint is nothing but an elimination of potential income. In addition, it was said that the small farmer would re-plant seeds that did not emerge with seeds from local sources so that his "seed" yield would improve. In other words, if a farmer is given an incentive for growing seed, then the seed purchased must be strictly controlled in accordance with quality standards. This, however, may not be possible considering the actual constraints in North Cameroon. The farmer may be convinced, on the other hand, that improved seeds are desirable, and thereby be motivated to plant his own seed crop (or for his home village) under the technical assistance of the extension agent.

f. The project is staffed by 6 agronomists trained to the BS level in Cameroon. Four of the six technicians have completed 6-9 months specialized studies in the U.S. (3 in seed technology, 1 in extension). Of the remaining two, one has participated in short term seeds training in Senegal and the other is a recent graduate. During the past 4 years, therefore, specialized training has been received by the NCSP technical staff. The results of this training are only beginning to be felt due to the limited amount of time on-the-job after the training programs.

The staff is production oriented, and no practiced division of labor was observed to be followed in regard to production. quality control, and information dissemination.

g. Based on the Miss. State's interviews with the project staff and observations made, a viable quality control program has yet to be developed within the framework of the project.

h. Due to various factors detailed in this report, and the lack of a viable quality control program since receiving the breeder seed from IRA-North 4 years ago, it is apparent to the Miss. State team that the seed in storage at this time (Jan. 1980) is of unknown quality and questionable pedigree. This is an intolerable situation in a seeds project. This seed must not be distributed as improved varieties of superior quality, not be used to plant the 1980 foundation seed crop.

2.8 Policy Change

A letter dated 4 December 1979 from the Ministry of Economic Affairs and Planning requested USAID to study the possibilities of limiting the scope of the NCSP to food crop seed production on State-operated farms.

The state operated "Foundation" seed farms would supply the needs for the North Province - particularily for the projected Center-North project under consideration for funding by the World Bank.

2.9 FAO Project

A 12-month technical cooperation program was agreed upon by the GRUC and FAO. The objectives of the technical assistance can be summarized as follows:

1. Design of a National Seeds Program

2. Define the costs over a 5-year period

3. Prepare with USAID a first project document that will be presented to USAID for financing (approximate financing: $5 million)

To arrive at the objectives indicated, FAO has stationed a senior seeds specialist in Yaounde for 12 months. He will receive approximately 2 pm of consulting assistance in addition to his travel and local expense costs.

The FAO specialist will be assigned a counterpart in MIDEVIV.
The FAO specialist arrived during the last days of the consulting period of the Miss. State team and was briefed concerning the results of this study.

3.0 TECHNICAL BACKGROUND FOR SEED PROGRAM DEVELOPMENT*

3.1 Introduction

In traditional agricultural as practiced for hundred of generations and still prevalent in many areas today, the cultivator sets aside a part of each season's production to plant the succeeding crop. Beyond this practice, little distinction is made between the edible grain and regenerative seed. A progressive agriculture, however, requires the rapid and effective multiplication and dissemination of improvements in crop varieities as they are effected. Traditional metnods will not suffice.

A well organized, effective seed program-industry is an important - and really more basic - to continued agricultural progress as are supply programs for fertilizers, pesticides, irrigation, credit and so on. Considerable progress can be made by introducting and widely disseminating large quantities of seed of high yielding varieities obtained from foreign sources. In a season or two many of the cultivators will

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* Gleanings from the document "Seed Program Development" prepared by MSU (Contract: AID CSD-1203).

be planting the improved seed with dramatic short term gains in productivity. But what of the long run? How long will it take for the improved germ plasm to be effectively neutralized through dilution in the "local" gene pool by field contamination, mechanical mixing and/or outcrosses? How can "second generation" varieities of the same general plant type and statue but with improved nutritive value, disease resistance, and yield potential be introduced without almost immediate loss of identity?

Analysts involved in assessing the economic benefits to be derived from a seed program should take into account the following considerations:

1. The seed program per se is probably not the proper focus for strict cost benefit ratio analysis. Rather, such analysis should be applied to the total crop improvement or plant breeding program of which the seed program is an essential extension.

2. Seed of most major crops are a reproducible, multiplying input (exceptions: seed of hybrids and possibly some vegetable and forage crops). A specific acreage of the immediate crop is benefited by the level of primary input (quanity of new seed planted), while geometrically progressing acreages of succeeding crops are (or can be) benefited by the progeny of the primary input. In this manner, seed are unique among production inputs in crop husbandry.

3. An efficient seed industry serves not only in agricultural development but also as a mechanism for the rapid rehabilitation of agriculture in the wake of natural disasters such as floods, drought, epiphytotics, etc. Witness, the marvelous efficiency of the U.S. seed industry in replacing southern corn leaf blight susceptible corn hybrids with blight tolerant hybrids in less than two years, or the urgent need for seed after the natural disaster in East Pakistan in 1970. Thus, the potential of a seed program-industry as a sort of disaster insurance cannot be overlooked in computing its benefits.

4. In some countries, or states therein, a completely objective economic and technical justification for a comprehensive seed program may not be possible. Importations and/or establishment of a distribution-marketing system might be adequate in the context of current and/or projected development plans. Politically, however, seed program - at least for major food crops - is almost always a necessity for no government can afford to "jeopardize" food production by placing its cultivators at the "mercy" of external suppliers of such a basic item as seed. Furthermore, all countries, provinces, villages, and individual cultivators already have a "seed program". If this were not the case, there would be no seed to plant. These programs differ only in scope, level of sophistication, and degree of effectiveness or ineffectiveness.

Specific benefits of a seed program-industry that produces and supplies high quality seed of superior varieities include:

1. Increase in total yield resulting from the introduction and distribution of superior varieities or hybrids into the cropping pattern of the country or sub-division thereof.

2. Increase in "recoverable yield" as a result of greater varietal purity, more uniform maturation, and so on.

3. Increase in yield resulting from higher physiological quality of planting seed. This increase in yield is distinct from the "genetic" component and is derived from better stands and individually more productive plants. Experiments have shown that high germinating, high vigor seed can produce 10-20% higher yields than low quality seed of the same variety in equivalent populations.

4. More efficient utilization of fertilizers, irrigation and pesticides because of greater uniformity of emergence and growth, better stands, and more vigorous plants.

5. Reduction in planting rate. When high quality seed are available, seeding rate can generally be reduced by about one-half, thus, effectively adding a like amount to the food supply.

6. Higher quality of produce because of less contamination with other varieties, and more uniform maturation, thus, fewer immature and/or weathered seed. For e ample: hulling and milling turnout of rice is much higher for uniform grain (same variety) than mixed grain.

7. Less re-infestation of the land with weed seed.

8. Less disease and soil insect problems in seed beds and fields as a result of minimization of plants infested with "seed-borne" diseases in seed production fields and seed treatment.

9. More rapid and efficient periodic replacement of varieties with newer and better varieties.

10. Facilitates introduction of new crops into the agriculture of a region or country.

3.3 Pilot or Model Program

The Foundation Seed Project or Program is almost ideally suited to serve as a vehicle for launching a comprehensive seed program. In many ways the Foundation Seed Program is or should be a complete seed program. It starts with breeder seed, engages in seed production, harvesting, drying, processing, storage, marketing and distribution, it often legally

sanctioned, and has a training - education component. Furthermore, production and supply of foundation seed of publicly developed varieties is a public sector function. Since the first steps in seed program development in most of the less developed countries will have to be within the Ministry of Agriculture or equivalent, why not structure and identify them as Foundation Seed Project or Program?

In the early stages the Foundation Seed Program might have to (and probably should) produce and supply seed for use by cultivators. Its orientation, however, can be maintained as an elite organization whose primary functions and role are to produce seed for seed producers, catalyze commercial seed production, and serve as a center of expertise, training, and information for the developing seed program-industry.

We recognize that enormous pressure for expansion into general seed production-supply will be generated if the Foundation Seed Program is at all successful, and the private sector is not alert and aggressive. Indeed, it (the Foundation Seed Program) might have to expand into general seed production if private sector participation doesn't materialize, and the demand for seed builds up. "Containment" of the Foundation Seed Program in its proper sphere and roles should not be too difficult, however, provided it was correctly structured and organized in the beginning and the government really wants the private sector to participate in the seed program and shoulder the bulk of the work in commercial seed production, processing, distribution and marketing.

Development of the Foundation Seed Program as a multi-purpose supply and service base of a seed program-industry requires that its staff consist of the very best plant scientists, specialists, and technicians possible, that it be well equipped and supported for its several functions, and that it be under the over-all management of an imaginative, resourceful, and thoroughly professional administrator.

This section can be summarized with the traditional words of caution - Proceed Slowly. The urgency of seed needs may (and probably will) generate such enormous pressures that something will have to be done and done rapidly. If this is the case, employ makeshift and temporary arrangements to relieve some of the pressure but do not incorporate them into the program and be sure they are temporary.

3.3 Seed Release and Multiplication

"A good seed program...involves a number of components, each of which may be likened to the links in a chain. And, like a chain if one of the links is weak the chain is also weak. Some of the links are common to all agriculture; others are peculiarly related to seed."*

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* D.D. Hill. Seed and the World We Live In. Foreign Agriculture, FAS, USDA. January, 1961.

Our experiences suggest that one of the most serious impediments to establishment of a seed program-industry in the less developed countries is an inadequate and/or incomplete understanding of just what a seed program is and what it is not. Many of the other difficulties, problems and frustrations that attend developing seed programs derive at least in part from this misunderstanding.

A clear concept and understanding of the varied and often unique elements of a balanced seed program and their inter-relationships logically constitute a part of the background needed for informed planning and effective organization.

One of the first steps in development of a seed program is establishment of an orderly mechanism for the "release" of a new variety and its entry into the seed multiplication and production scheme. Generally, the decision to release an improved variety is made by the Administrator in charge of the agricultural research agency responsible for varietal improvement on the basis of a recommendation made to him by a Variety Release Board. The Variety Release Board is an advisory group of 6 to 8 persons representing research, extension, development, and credit agencies and the private agricultural community, appointed by the Minister of Agriculture or equivalent. The functions of the committee are to review the history and performance record of nominated varieties, determine their potential contribution to the national agriculture, make recommendations pertaining to their release and entry into the seed multiplication and production scheme, and equally important - to make recommendations on discontinuation of obsolete varieties.

3.4 Seed Production

Basic seed production practices include the following:

1. Source of seed: The planting stock used for seed production must be varietally pure and of known origin.

2. Land selection: Seed should not be produced on land that was planted to another variety of the same or similar crop the preceeding season. This prevents varietal mixtures resulting from "volunteer" plants. The land should also be relatively free from troublesome weeds.

3. Isolation: Seed fields have to be physically isolated from other fields planted to other varieties to prevent out-crossing and mechanical mixtures. The isolation distance is determined by the mode of pollination of the species, and the prevailing environmental conditions.

4. Roguing: Seed fields are "rogued" several times to remove off-types, other varietal contaminants, diseased plants, other crop plants, and troublesome weeds.

5. Inspections: Seed fields are inspected at least once to check on isolation distance, presence and incidence of off-types, other varieties and crops, troublesome weeds and diseases. The equipment used for planting, harvesting, drying, processing and storage should also be inspected for cleanliness.

The basic fertilization, irrigation, and other cultural practices recommended for commercial grain crops of the same kind are used in seed production with special attention to prevent moisture stress during seed formation and development and to control weeds.

3.5 Breeder Seed

The "handful of seed" that represents a newly developed variety is the end of the breeders principal job and the beginning of the seed specialists job. The release of a small quantity of breeder seed may represent the culmination of many years of dedicated work by the breeder involving hybridization, inbreeding, selection and testing, but cannot be considered the end of his responsibility. He must maintain a small annual or seasonal increase of the breeder seed, for it cut off, the variety will deteriorate and disappear in a few years. It is essential that the originating breeder, his assistants and his institution assume the responsibility to see that this job is done.

Breeder seed are produced on a very small scale (usually less than a hectare) so that it can be rigorously rogued of all off-types and other contaminants. Breeder seed must be the "purest" seed. Otherwise, the tasks of the foundation and commercial seed producer become nearly impossible.

Although breeder seed are produced in small quantity, the breeder must be provided with or have access to plot size harvesting, drying and cleaning equipment. Additionally, the research station should have access to controlled environment (dry and cool) room for storage of breeder seed. This will serve two purposes: the breeder will not have to devote time to seed production every year, and a reserve of breeder seed can be maintained as a safeguard against loss of the supply of breeder seed through a disaster of any kind.

3.6 Foundation Seed

Foundation Seed are the progeny of breeder seed so handled as to most nearly maintain genetic purity and identity. Thus, they constitute the second link in the multiplication chain and the base for commercial seed production. The essential task of the foundation seed program is to multiply breeder seed up to quantity required for large scale production of commercial seed. The size of the foundation seed multiplication operation may be small or large depending upon the number of varieities that must be increased and the amount of seed required to service further multiplication steps.

Foundation seed production cannot be a haphazard operation. It must be carried out under the close supervision of a well trained and thoroughly competent plant scientist with a good working knowledge of plant breeding and agronomy and major training or experience in seed technology. His assistants must likewise be well trained, competent and dedicated. Furthermore, the program must be adequately equipped, supplied, and funded to do the best job possible.

The Foundation Seed Organization is supported by the Ministry of Agriculture or by a semi-autonomous governmental corporation under the general guidance of the Ministry of Agriculture but not subject to the bureaucracy and rigid fiscal policies of government.

The following organizational suggestions are made regarding a Foundation Seed program:

1. It should be administratively sanctioned.

2. It should operate under the control of a National Seeds Committee in accord with the provisions of defined responsibilities.

3. The National Seeds Committee (6 to 8 members) should be selected from interested organizations or parties such as the research service, extension service, agricultural administration, credit organization, farmers or any other concerned or interested organizations or individuals.

4. The production, processing and handling of foundation seed should be under the direct technical supervision of a qualified project leader in accord with policies established by the National Seeds Committee.

5. The organization must be financed from public funds unless it can become self sustaining through sales of foundation seed to commercial producers.

6. There should be only one Foundation Seed Program for publicly developed varieties per country.

3.7 Harvesting

Harvesting and drying are critical operations in the seed program. The basic quality of planting seed is never higher than it was at harvest - but it can be infinitely worse. All harvesting and threshing operations, therefore, must be performed in a careful and timely manner.

Harvesting and threshing of seed of crops normally grown for their "seed" or grain follow essentially the same procedures as used for grain except that they are usually done at a higher seed moisture content (16 to 25%) to minimize field deterioration and damage of the seed by adverse weather, molds, insects, birds, rodents, etc., and strict precautions

are taken to prevent damage to the seed, and mechanical mixture with seed of other varieties or crops.

3.8 Drying

As indicated above seed should be harvested at moisture contents above 16-18% to minimize deterioration, damage and losses. While this procedure is almost essential for production of high quality seed, producers following it are immediately confronted with a serious problem. High moisture content seed in a warm temperature environment rapidly lose viability and vigor. Thus after harvest, seed moisture content must be rapidly reduced to 13% or less (11% or less for oil and vegetable seeds).

Since seed production is usually concentrated in fairly large acreages, traditional shocking and sun drying methods are generally too cumbersome, inefficient and ineffective. Some system of forced air drying with or without heat is required.

3.9 Temporary Storage

The seed drying operation - as previously discussed - cannot be delayed. It must commence immediately after harvest and proceed to completion without interruption. Operations subsequent to drying, however, are not as urgent. It is usually neither necessary nor desirable to match rate of processing with rate of drying. In most cases the costs of processing equipment would be prohibitive. Processing, therefore, takes place over a longer time span than drying. As a consequence, temporary or holding storage facilities are required for the dried seed until they can be processed and packaged. These may encompass the drying bins themselves with additional metal or wooden bins, or warehouse (flat storage) storage units. During processing the seed are unloaded from holding storage and moved to the processing plant by conveyors or by hand.

3.10 Cleaning

The dried seed normally contain contaminants and foreign material mixed in with the good seed: broken, diseased, and insect damaged seed, chaff and straw, weed seeds, other plant parts, etc. The first step in seed processing is removal of these contaminants and foreign matter. In undeveloped agriculture, the seed are "cleaned" by winnowing and simple sieving. Such methods, however, will not suffice for the quantities of seed handled in a seed program. Better and more efficient procedures are needed.

Basic seed cleaning is usually accomplished with an air-screen cleaner. These cleaners are available in many variations of size, shape, capacity, etc., but basically consist of integrated screening (sieving) and air systems. The seed are fed from a hopper through a series of vibrating screens to remove contaminants lighter than the good seed.

In its simplest form a seed cleaning system consists of an elevator to lift seed into the hopper of the air-screen, the cleaner itself, and bagging-weighing-attachments.

3.11 Sizing

During or after cleaning it is desirable to size grade to improve quality. Small, immature and shriveled seed are removed during cleaning along with other contaminants.

3.12 Treating

Treatment of seed with various fungicides and insecticides to protect them from storage and soil borne insects and fungi is a recommended practice for many kinds of seed: corn, wheat, peanuts, sorghum, rice, etc. Since the dosage and uniformity of coverage of the chemicals are important, treatment is best accomplished with a seed treating machine that applies the chemicals at the desired rate and distributes them uniformly on the seed.

Seed treating is usually done during processing just before packaging. It should be recognized, however, that seed treatment chemicals are poisonous and treated seed that are not used for planting cannot be used for food, feed or industrial purposes. As a result of this situation it is often desirable to treat only a portion of the seed during processing (the highest quality seed with assured market) and/or to delay treatment until just before the shipping season. Strict precautions must always be taken to safeguard the health of the workers and to prevent the diversion of treated seed to food, feed, or industrial markets.

3.13 Packaging

The final step in processing is packaging. Weighed quantities of clean seed are packaged in cloth or paper bags, the bags are closed by sewing or gluing, and tags are attached. Bags are an expendable supply item and should not be reused for seed. They may of course be used for other purposes if the seed were not treated.

3.14 Seed Storage

In North Cameroon, the most important factor affecting storage of seed is the quality of seed produced and processed before storage. This is explained as follows. High temperatures and relative humidities affect seed directly and indirectly. Seed are hygroscopic so that their moisture content is in equilibrium with the ambient relative humidity. When relative humidity is high, seed moisture content is also high; when it is low, seed moisture content is low. High seed moisture contents combined with warm temperatures greatly accelerate the natural processes of seed degeneration so that under such conditions seed rapidly lose vigor and somewhat later their capacity to germinate.

Therefore, the dry conditions in North Cameroon during the storage season not only reduces the rate of physiological deterioration of seed, but also helps to control storage molds and insects. The main point to make is that low quality seed do not store well even under very good conditions. Put another way, good storage facilities do not compensate for improper and poorly managed harvesting, drying, processing and packaging. The first principle of successful seed storage, therfore, is to start with clean, high quality seed.

Several general principles pertaining to seed storage are given below.

1. High quality seed store better under any conditions than low quality seed.

2. Seed kinds differ inherently in storage potential. Several major kinds of seed are classified below:

Good Storers	Fair to Poor Storers
Rice	Soybeans
Corn	Peanuts
Wheat	Other oil seed
Sorghum	Edible beans
Millet	Most vegetable seed

3. Seed moisture content (or relative humidity) and storage temperature are the two most important factors in storage of seed. Of these two, relative humidity (seed moisture content) is most important.

4. Good quality seed of the cereal grains (wheat, rice, corn, etc.) will store well for 6-9 months under most temperature conditions encountered provided seed moisture content is maintained below 12% and insects are controlled. Oil seeds and seed high in proteins will usually store well under the same conditions and for the same period provided moisture content is maintained below 10%.

5. Sealed storage of seed* (metal cans, moisture vapor proof plastic, aluminum foil laminated paper-plastic bags, etc.) requires that seed moisture content be reduced even further for safe storage - 10% or less for cereal seed and 9% or less for oil seed. The safe storage period, however, will be extended by sealed storage.

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* This may well be the best method for the small farmer to use. The average farm has about 0.3-0.4 ha. in peanut production in North Cameroon. This means that the farm needs about 35 kgs. of seed to plant each year, a small quantity. Research is needed.

6. Sanitation - rigorous and continuous sanitation - is a must for successful storage. The area inside and surrounding the storage house should be clean and free of trash, weeds, straw, spilled seed, and so on. Periodic spraying of the interior of the warehouse and around the outside is very helpful in controlling insects as is periodic fumigation. Seed should not be stored next to fertilizers or herbicides. Elevation of the floor of a storage warehouse about 1 meter, close fitting doors, and cleanliness around the storage building will minimize rodent problems.

3.15 Quality Control

Quality Control is the systematic approach toward achievement and/or maintenance of desired quality standards of a production or service - seed in our case. In terms of the seed program quality control has several aspects. It is:

1. A system and procedures for achieving specific seed quality standards.

2. A system for maintaining seed quality once standards have been achieved.

3. A method of approach in identifying seed quality problems (actual or potential) and effecting their resolution.

The ideal of high quality and the concept (and application) of quality control must permeate all phases of the seed program. Concern about quality and action to insure it begins with selection of the seed for multiplication, extends through production, harvesting, drying, processing, storage and distribution and ends only with satisfactory performance in the cultivators field.

Quality control integrates random and uncoordinated activities directed toward achievement and maintenance of quality standards into a comprehensive, systematic program. It does not permit vital operations or procedures to be accomplished or ignored by chance or the momentary whims of a technician.

What is seed quality? Although the phrase seed quality has been used throughout this text and is generally understood by agriculturalists, we should pause and consider more exactly what it means. Seed quality is the sum of many seed attributes or characteristics. In terms of individual seeds these attributes include trueness-to-variety (genetic purity), mechanical damage or injury, viability (germinability), vigor, disease infections, insect damage, treatment coverage, size, and appearance. Extended to the population of seed (the seed lot), quality characteristics include moisture content, incidence of contaminants (noxious and common weed seed, other crop seed, inert matter), uniformity (homogenity of the lot) and performance potential. Highest quality seed are genetically

pure, germinable, vigorous, intact, free from diseases and contaminants, properly sized, adequate treated (if treatment is recommended), and of over-all good appearance.

The ideal of highest quality is seldom achieved - few seed lots meet "ideal" specifications. For this reason, minimum quality standards are adopted or imposed in most seed operations. The minimum standards are established not as a goal - the goal is always highest quality - but as the lowest levels of the various quality factors that are acceptable under the usual conditions.

Seed testing must occupy a very prominent role in the seed program. The seed testing laboratory is very important, but it is only a service element in the seed program. Seed testing laboratories and certification agencies do not produce, process, or distribute seed to cultivators - which constitutes the main thrust of the program.

Seed are tested for the following reasons:

1. To determine their quality, i.e., their suitability for planting.

2. To identify quality problems and their probable cause.

3. To determine the need for drying and processing and specific procedures that should be used.

4. To determine if seed meet established quality standards or labelling specifications and requirements.

5. To establish quality and provide a basis for price and consumer discrimination among lots in the market place.

The emphasis on quality and improved varieties of seed cannot be too strong. It is not just a matter of the reputation of the seed project. It may be a question of survival for the farmer who puts his trust in seed purchased from a government which is attempting to improve his well-being.

4.0 NORTH CAMEROON SEEDS PROJECT - OPTIONS FOR PHASE II*

4.1 Project Description/Strategy for Phase II

The goal of this sub-project is to increase crop productivity and food supply for the rural poor of North Cameroon through increased cereal grain and peanut production, and to create a National Committee for Seeds. More specifically, the purpose of this collaborative USAID/FAO project is to assist the GURC to establish a workable national seed production, processing, marketing and quality control program capable of multiplying seed of improved varieties into quantities sufficient to assure their wide-spread availability, and this sub-project is one component of the overall effort.

The sub-project's goal and purpose will be attained when the NCSP attains and has the capacity to maintain on an annual basis a supply of high quality seed of improved varieties equal to the quantities of Foundation Seed adequate to plant sufficient area to increase the foundation seed in one generation to the annual seed requirement for the target crops in the North Province. The estimated annual demand for seed of improved varieties of each crop are presented in Table 12. Details of the demand estimates are discussed under the section Seed Multiplication.

All of the seed distributed under the auspices of the NCSP will be inspected both during its production and after processing to assure the using organization that the seed are of the variety indicated and, further, each bag of seed sold will have a label indicating the kind, variety, physical purity and germination of the seed contained therein. Minimum standards for the production and processing of genetically pure, high quality seed will be established consistent with internationally

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* The options presented in this section could be developed into the technical aspects of a project paper by future design teams or USAID/Y with REDSO-WA assistance if required. Areas where complete information was not available to the team are indicated, and specific details have not been developed to include cost estimates except in the case of the seed farm and the national laboratory equipment needs. USAID personnel presently working with the NCSP, and an audio-visual expert due to arrive within the next few months, are vital sources of information in many of the practical aspects relevant in the preparation of a new Project Paper. With the exception of a few brief interviews with the USAID extension advisor, and an evening at the home of one of the USAID project representatives in Maroua, the team did not benefit from an exchange of ideas with the three AID technicians working in the North with the NCSP.

recognized seed certification standards but starting at a level consistent with the climatic and technological restrictions existant in North Cameroon.

The National Seed Committee, created by government decree as a specialized department of the Mission for Food Crop Development (MIDEVIV), will be an advisory committee serving the national seed program in two ways. First, in terms of policy decisions concerning production, distribution and pricing of seeds, it will work in collaboration with the provincial agricultural division, research agencies and seed users. Second, in terms of quality control, it will build and staff a national seeds laboratory which will provide testing services to all seed projects. The national seeds laboratory will include seed inspection and sampling teams and an extension seeds expert to provide technical assistance to seed producers and prepare technical documentation on seeds for use at the national planning level (DEP/MINAGRI).

Two seed production/processing/storage facilities will be in operation to provide sufficient seed of the quality described for distribution by the NCSP to the Center-North Project, to the Young Farm Family Training Centers, to the Agricultural Offices ("Postes Agricoles"), to the North-East Benoue Settlement Scheme, and to other extension oriented projects working to increase production of the target crops in North Cameroon. These facilities* are already nominally in operation. A seed testing laboratory will be in operation to verify the physical and biological quality of the seeds before they are distributed.

The specialized extension personnel of the NCSP will work closely with all organizations receiving foundation seed. At least forty** sessions (during the 5-year sub-project) will be held in the dry season to train extension agents working in the North Province in all aspects of seed technology concerning the final multiplication of seeds at the small farm level. Each session will last one week. The training will include appropriate recommendations for production, varietal maintenance, harvesting, drying, and storage of seeds at the small farm level. During the production period, the extension specialists will have concentrated their efforts in 4 defined geographical areas which are to be considered pilot areas. The areas will be chosen so that the possibility of a significant impact is high, and restricted in actual area so that an effective program is assured. Good records will be kept on all activities in the pilot area, and applied research in seed technology at the small farm level will be pursued by investigating different methods of production, harvesting, drying, and storage. The investigative results will be based on the laboratory analyses of samples taken during

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* Danguere and Guetale Farms.

** 3 per month over 4 months per year

the different operational stages and sent to the Seed Testing Laboratory. Fact sheets will be prepared on the results of the applied research to be distributed to extension agents. A bi-monthly newsletter will be prepared informing the extension agents of the activities of the NCSP and presenting technical information related to seeds.

A most important key to the successful implementation of the NCSP-Phase II is widespread understanding of the role that good seed of improved varieties can play an increasing agricultural productivity. Indeed, if those persons working with and advising the farmers are not fully aware of the importance and availability of good seed of superior varieties, farmer acceptance will lag to the point of making the varietal development research and seed multiplication activities of little value. To circumvent this potential problem, the 40 one-week training sessions and the pilot area activities will have as a general theme "seed appreciation" and the courses will be conducted by NCSP personnel with support from international technicians. The participants of the courses should represent the different agencies receiving seeds. These courses will also provide for a continuous flow of information concerning seed needs from the small farmer back to the NCSP and eventually IRA-North ("feedback").

The NCSP-Phase II will build on existing infrastructure and seek to coordinate and give guidance to the agricultural activities which are already in operation. It is essential to the success of the seed program that these activities be continued. Research and extension activities are receiving assistance from USAID-sponsored projects, other donors, and international organizations (IITA and ICRISAT have started programs with IRA-North). It is appropriate to mention in this respect the forthcoming Center-North Project. This project working in the most populous area of the North Province, is scheduled to be signed within the next year, and will contribute significantly to the food crop production and agriculture in general. It is anticipated that the agreement between the World Bank and GRUC will exceed $55 million dollars. At this time, the NCSP is being proposed to supply the Center-North Project with foundation seed. However, there is considerable hesitation on the part of MINAGRI and the World Bank to accept this proposal due to the present technical and financial constraints of the NCSP. It is of no small importance that the NCSP be reorganized before beginning the 1980 planting season, or it risks elimination in favor of foundation seed production within the SODECOTON infrastructure. This does not seem desirable from neither a technical viewpoint (SODECOTON is extension oriented and the Center-North design team rejected the idea of financing a viable foundation seed projection component presented to the World Bank team by the NCSP) nor from the viewpoint of USAID which has invested considerable time and effort in a feasible and relevant project.

The GRUC/USAID financed NCSP was an extremely positive response on the part of MINAGRI to gain support at the national level for the multiplication of the seed input. However, the first phase was not

funded at a level sufficient to provide in infrastructure, farm facilities, or the unusually high levels of technical assistance needed to fulfill the assigned responsibilities. The USAID/FAO/GRUC project will complete the support necessary for the development of a comprehensive sub-project in the North and its collaborating national support services.

One long term U.S. technical assistance expert to be provided will have the major responsibility for proper installation of the two processing/storage centers and equipment maintenance.* He will train counterparts in the proper operation and management of these facilities (see Annex III for the job description). He will receive technical assistance when needed (see section on consultant services).

A second long-term expert will assist in the operation of the National Seed Testing Laboratory, and will train those persons assigned to the laboratory which will be constructed and equipped through the USAID sub-project.

In concert with the NCSP director and his staff, the two international technicians will cooperate in an intensive in-country, U.S., and third country training program. In addition to on-the-job training as the various facilities are completed, specific in-country training courses will be conducted to develop personnel with those technical skills necessary to assure proper understanding and implementation of the production, processing, and quality control aspect.

Carefully selected individuals will be sent to the third country training courses to expand the base of technically trained personnel. This should not be limited only to "seeds" training per se as production and machinery problems are exceeding the training of the project technicians. A total of nearly 40 NCSP, IRA-North, SODECOTON, MINAGRI, MIDEVIV and other extension agents will receive from three weeks to three months techical training in the various aspects of seed technology, farm management, and administration procedures.

To provide the small core of indivjduals with the in-depth education necessary for continued development during and after this 5-year project, four NCSP personnel will be trained to the MS level in Seed Technology in the U.S. Intermediate level training will be provided to 10 technicians such as extension seed specialists, seed inspectors, production center managers and assistant managers.

A total of 15 pm short-term consultant services are to be provided during the 5-year project. These services will be needed in support of the in-country training activities, project re-organization, start-up of the quality control program, peanut seed production, and to assist in completion of the facilities.

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* Such an expert was recently hired on a short-term contract, who appears well qualified for this position.

An agreement will be passed between IRA-NORD and the NCSP (that is, between their respective agencies DGRST and MIDEVIV) for the annual supply of breeder seed of peanuts, wet and dry season sorghum varieties, maize,millet and green manure crops. In addition, IRA-North will be requested to assist the farm agronomists in applied research on the seed farms to help overcome production difficulties. Small research plots will be established on the farms to investigate fertilization practices, insecticide treatments, seed treatments, herbicide treatments and different cultural practices (such as bedding vs. non-bedding). This is neither all that difficult, nor time consuming, to the farm agronomist if he does not have to set up the trials and analyze the results but is required only to occasionally collect data or make a treatment. The IRA-North researcher would be present at planting (1-2 days), harvest (1-2 days) and possibly bi-weekly during the growing season (8-9 days). Such a relationship has proven successful between IRA-North and the SEMRY project. If IRA cannot handle the applied research, in-country or international consultant help will be required as a multitude of production issues are being cited in the actual project, and the project staff is blindly expecting some expert to come along and solve all of their problems. However, lacking field-correlated, sophisticated soil testing facilities, or appropriate research done on similar soils in similar eco-climatic regions, the only solution to these problems will be found by relatively simple, but extremely valuable, applied research on the issues in question.

Each farm will have prepared a detailed soils map, and topographic survey. In the case of Guetale, the work has probably been done. However, Sanguere, being a new creation, will require an experienced consultant (assumed to be available through the IRA network) to map the farm and counsel on proper anti-erosive measures to be taken in mechanized production. Fields should be marked out if not already done.

The equipment and buildings to be supplied are minimal in respect to the sub-projects needs. The material support represents an expansion, coordination and improvement of technology. Vehicle needs (trucks, cars) remain to be evaluated as does warehousing capacities of the organizations receiving seeds. Maintenance facilities are basic but crucial.

Adequate housing must be available or provided by the sub-project. The situation apears bleak at Guetale and construction of living quarters is likely to be required. Further study is needed to clarify this important issue.

Finally but not least important, USAID and GRUC will cooperate in the immediate assignment of an experienced peanut breeder to IRA-North.

4.2 The Technical Program

There are three options for foundation seed production in the northern province: (1) contract farmers, (2) foundation seed production centers, or (3) within the framework of SODECOTON. The team's observations and experience rules out the small farmer for foundation seed production, and recommends that the foundation seed be of sufficient quantity so that only one multiplication will be necessary by the small farmer to satisfy his total needs the following year. SODECOTON was interviewed, but provided no information to the team and it is therefore difficult to make a definitive statement concerning this option. Probably it would be safe to say that SODECOTON would be capable of producting quality seed if it so desired (it apparently does so for cotton at this time). However, the effort and infrastructure required to do so for food crops may not be of first priority. In addition, SODECOTON is oriented towards extension and marketing.

The third option, that is, foundation seed farms, is considered by the team to be the only reasonable option. The organizational infrastructure for foundation seed farms already exists* except that it is being reorganized and may experience a drying up of funding.

The physical locations of the existing NCSP's seed farms are indicated on Figure 2. The NCSP headquarters is located in Maroua. The MIDEVIV national office and proposed location of the recommended MIDEVIV department "National Seeds Committee" are located in Yaounde. The National Seed Testing Laboratory is recommended to be located in Yaounde or in close proximity.

The sites of the two existing centers recommended for foundation seed production are located one in each major eco-climatic zone in the northern province. This is widely recommended because of the whims of rainfall and climate in the region. Electricity is not available at either farm - a regrettable fact. The Sanguere center is within easy access of Garoua by mostly paved road. The Guetale center, although somewhat remote, is served by good all-season roads and is an excellent facility with well-planned fields, and useful infrastructure left over from the days when it was a French-run research center.

Studies must be undertaken immediately to determine a working solution to the electricity problem at both farm sites. At Sanguere, it may be possible to tie-in to a utility line within a "reasonable" distance from the farm according to some of the NCSP staff. At Guetale there is no alternative but to install a generator. The generator must be one that can be maintained through existing, proven structures.

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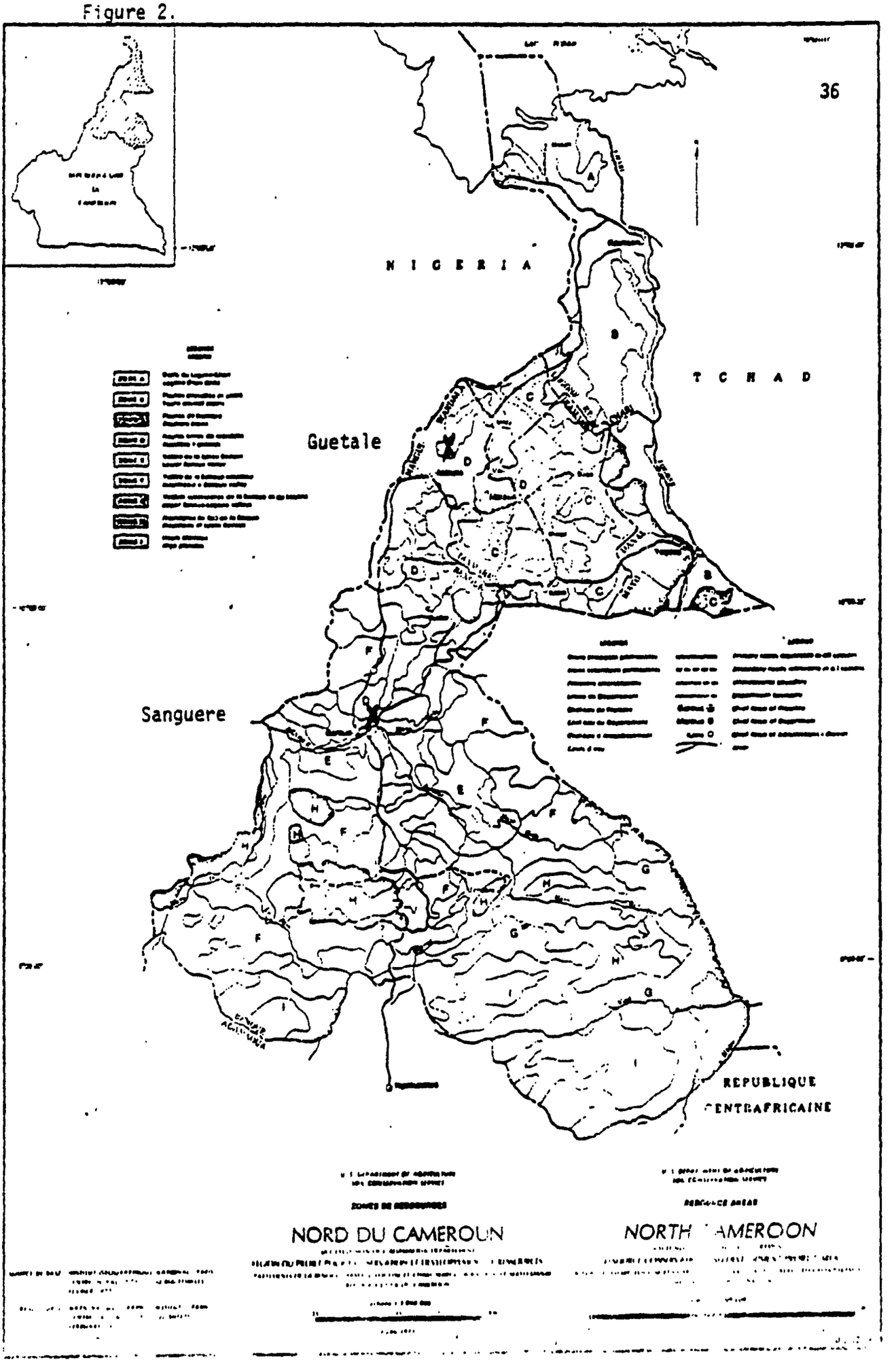
* North Cameroon Seed Multiplication Project.

Figure 2.


36
NIGERIA
TCHAD
Guetale
Sanguere
REPUBLIQUE
CENTRAFRICAINE
NORD DU CAMEROUN
NORTH CAMEROON

A complicating fact at Guetale is that the seed farm is located adjacent to the small town of Guetale and a Young Farm Family Training Center. Installing a generator for the seed farm and its resident personnel while local government officials and others hear the hum and see the lights does not appear to be a healthy situation. Therefore, it is essential that a study be made for the potential electric users at Guetale and an agreement signed detailling the responsiblitlities of maintenance, cost sharing, etc. at this time.

4.3 Seed Demand/Multiplication

Demand for seed is a function of three major variables: (1) the value of the seed to the farmer, (2) the cost and availability of the seed to the farmer, and (3) the replacement rate of the seed. The technical replacement rate is determined by the type of crop grown and its mode of pollination.

When beginning a seed multiplication program it is not practical to initiate a three stage multiplication program (i.e., Foundation - Registered - Certified) due to inexperience on the part of those involved. This is the case for the NCSP, where a two stage multiplication system is recommended (i.e., Foundation-Multiplied). As those involved in the seed multiplication process gain experience, the seed program will gain efficiency in use of foundation seed.

At the implementation of a certified seed program, the NCSP will provide quality control and processing services, on a fee basis if possible. The NCSP will inspect all seed production fields before planting and at appropriate times during the growing season to assume compliance with standards which will be developed and, later, an additional inspection of the processed, packaged seed will be made. All certified seed production which meets the field standards will be cleaned, packaged, and stored at one of the processing centers. It is reiterated that this broadening of project activities to include certification will only be appropriate after the first step of implementing "modern" seed production and harvesting practices at the state-operated Foundation Seed Farms. As individual farmers, or better still the various peasant associations and cooperatives become established and capable, and "seeds" become known as a desirable production imput different from "grain", then will certified seed production become technically feasible.

In the estimated demand calculations presented in Tables 7-11, the "estimated farmer acceptance rate" is the factor used to take into consideration the major variables of seed demand. In the case of unhulled peanuts (Table 7), it will be noticed that the North Province has been divided into 3 catagories. In the first, or the Center-North project area, the demand for peanut seed on farms using improved techniques uses an estimated farmer acceptance rate of 33% per year. Improved production techniques is based on improved seed and if the seed is renewed every three years we have .33 x 3 =.99 or the estimation that 100% of the farmers in the Center-North area using improved techniques

will use improved seed. If the estimated farmer acceptance rate is 10% per year and the seed is renewed every three years, this indicates that 30% of the farmers are using improved seeds. This may be the case for many reasons such as distribution problems, farmer acceptability problems, or maybe the lack of a viable extension service in a region.

A time framed generalized scheme for multiplication and production of a new variety of seed can be presented in 5 steps:

1. The scheme starts with the quantity of seed released by the breeding program.

2. Three years are required to attain the seasonal (or annual) supply of seed needed for cultivators. (It is often advisable to divert a portion of seed produced by 2nd and 3rd multiplications to selected farmers for early farm increase and further evaluation. In turn, the selected farmers "save" seed for themselves and supply some to their neighbors).

3. Three years or seasons after release all multiplication steps are operative each season.* (Exception: the breeder may elect to produce a 2 to 3 year supply of seed at appropriate intervals rather than each year. This is a sound procedure provided conditions (cool, dry) storage is available).

4. The source of seed produced by any of the multiplication steps through the commercial seed class (produce of 3rd multiplication) is traceable to breeder seed.

5. The assumption was made in this generalized scheme that the crop was self-pollinating, therefore the farmers can "save" their own planting seed for 3 years provided reasonable precautions are taken to minimize mixtures with other varieties. With proper isolation and attention, seed of cross pollinated crops can also be "saved" for several years by farmers. The point is this, it is not necessary to plan for annual resupply of seed to all farmers. Rather emphasis should be directed toward getting the farmer to renew seed about every 3 years. Thus, the planned seasonal annual supply of seed should be sufficient to plant 33% of the total acreage.

In the case of the proposed sub-project, the NCSP will receive breeder seed from IRA-Nord (called Elite I or II at IRA).

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* That is; breeder seed (M0), M1, M2, and M3 are planted for multiplication each year in their respective fields.

In one or two multiplications, depending on the crop in question, the NCSP will increase the breeder seed. This will be known as M1 and M2 seed.

M1 seed (or 1st multiplication) will not leave the seed production farms except for evaluation purposes and an adequate security stock of M1 will be maintained on the farms and in cold storage.

M2 seed (2nd multiplication) will also be known as Foundation Seed (Semences de Base). M2 seed will be distributed to the receiving agencies (i.e., SODECOTON, Postes Agricoles, and other projects).

The quantities of Foundation Seed will be adequate to plant sufficient area to increase the foundation seed in one generation to the estimated demand for that crop. This will be done by the development agencies with the technical assistance of the NCSP (at the beginning this will be limited to one or two extension seeds specialists during production, and training seminars during the dry season).

Eventually, this multiplication (M3 will be "certified" by the project as staffing and experience dictate*.

Table 5 summarizes the estimated seed yields for the crops in question. It is noted that the seed yield is between 30-40% lower than the actual yield due to the elimination of broken grains, sizing, etc. It is also noted that the actual yield per hectare is low for production under good management. Yields are reduced in seed crops when roguing, and sometimes isolation requires the seed technologist to eliminate parts of the field to maintain varietal purity.

Table 6 summarizes the planting rate and the estimated quality seed yield. The multiplier indicates the magnitude of seed increase per generation.

Tables 7 - 11 present the estimated seed demand for the target crops in North Cameroon. Two documents were used to prepare these estimates: (1) Projet de Developpement Rural, Region Centre-Nord (TOME I, June 1978), MINEP) and (2) the Resource Inventory of North Cameroon (April 1977, USDA/FAC). It is noted that the estimated crop production area outside the Center-North Project is assumed to remain constant. If a large discrepancy between the two documents occurred, the figure for the North province excluding the Center-North Project area was adjusted downwards from that indicated in the Resource Inventory to obtain the Provincial total of that document. This discrepancy is assumed to be due to the fact that the Resource area "C" does not exactly correspond to the Center-North project area.

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* One generation increase felt necessary due to apparent problems of quality seed production by the small farmer.

Table 5. Seed Yields

CROP	Yield (MT)/ Hectare	Estimated Processing Losses (clean-out) %	Quality Seed Yield (MT/hectare)
1. Peanut	1.4	30	1.0
2. Sorghum (wet season)	1.5	40	0.9
3. Sorghum (dry season)	1.0	40	0.6
4. Maize	1.8	35	1.2
5. Millet	1.4	40	0.8

Table 6. Seed Increase Multiplier

CROP	Planting Rate (kg/ha)	Estimated Quality Seed Yield 1/ (kg/ha)	Multiplier 2/
Peanuts	100	1,000	10
Sorghum (wet season)	10	900	90
Sorghum (dry season)	8	600	75
Maize	25	1,200	48
Millet	8	800	100

1/ See Table 5.

2/ In other words, if you plant 215 MT of peanuts for multiplication, you would expect to have a quality seed yield of 215 x 10 or 2,150 MT. (This does not represent actual yields).

Table 7. Estimated Demand for Un-hulled Peanut Seed of Improved Varieties Produced and Distributed by NCSP - Phase II in Fourth Project Year (1984).

REGION	Estimated Area Planted 1/ (hectares)	Seed Requirement (MT) 2/	Estimated Farmer Acceptance Rate (%/yr) 1/	Estimated Demand (MT/yr)
1. Center-North Project Using Improved Techniques	45,000	4,500	33	1,485
2. Center-North Project Using Traditional Methods	5,000	500	17	85
3. North Province excluding Center-North Project	58,000	5,800	10	580
TOTALS	108,000	10,800	--	2,150

1/ See Text for explanation of data presented.

2/ Seeding rate 100 kg./hectare of un-hulled peanuts.

Table 8. Estimated Demand for Wet Season Sorghum Seed of Improved Varieties Produced and Distributed by NCSP - Phase II in Fourth Project Year (1984).

REGION	Estimated Area Planted 1/ (hectares)	Seed Requirement (MT) 2/	Estimated Farmer Acceptance Rate (%/yr) 1/	Estimated Demand (MT/yr)
1. Center-North Project Using Improved Techniques	75,800	758	25	190
2. Center-North Project Using Traditional Methods	94,200	942	17	160
3. North Province excluding Center-North Project	55,400	554	10	55
TOTALS	225,400	2,254	---	405

1/ See Text for explanation of data presented.

2/ Seeding rate 100 kg./hectare.

Table 9. Estimated Demand for Transplanted Dry Season Sorghum Seed of Improved Varieties Produced and Distributed by NCSP - Phase II in Fourth Project Year

REGION	Estimated Area Planted 1/ (hectares)	Seed Requirement (MT) 2/	Estimated Farmer Acceptance Rate (%/yr) 1/	Estimated Demand (MT/yr)
1. Center-North Project Using Improved Techniques	119,000	952	25	238
2. Center-North Project Using Traditional Methods	6,000	48	17	8
3. North Province excluding Center-North Project	P.M.	--	--	--
TOTALS	125,000	1,000	--	246

1/ See Text for explanation of data presented.

2/ Seeding rate assumed to be 8 kg./hectare.

Table 10. Estimated Demand for Maize Seed of Improved Varieties Produced and Distributed by NCSP - Phase II in Fourth Project Year (1984)

REGION	Estimated Area Planted 1/ (hectares)	Seed Requirement (MT) 2/	Estimated Farmer Acceptance Rate (%/yr) 1/	Estimated Demand (MT/yr)
1. Center-North Project Using Improved Techniques	14,000	350	20	70
2. North Province excluding Center-North Project	11,100	278	10	28
TOTALS	25,100	628	--	98

1/ See Text for explanation of data presented.

2/ Seeding rate of 25 kg/hectare.

Table 11. Estimated Demand for Millet Seed of Improved Varieties Produced and Distributed by NCSP - Phase II in Fourth Project Year (1984)

REGION	Estimated Area Planted 1/ (hectares)	Seed Requirement (MT) 2/	Estimated Farmer Acceptance Rate (%/yr) 1/	Estimated Demand (MT/yr)
North Province	48,200	386	10	39

1/ See Text for explanation of data presented.

2/ Seeding rate of 8 kg/hectare.

Table 12 summarizes the quantities of multiplied seed required at each stage of the multiplication. It is noted that "green manure" has been added to this list. It is advised to establish a rotation at each of the seed farms using a suited green manure crop. Part of this crop may be allowed to run-to-seed for limited distribution to pilot projects attempting to promulgate the inclusion of a green manure into the small farmer's production program.

Table 13 summarizes the land requirements for each of the seed farms (approx. 125 ha per farm per year in production) and at IRA-North (approximately 2.33 ha annually).

Figure 3 presents the peanut multiplication scheme in graphic form.

The extension seeds expert for the project will work within the existing constraints to augment the awareness of seeds as an important factor in the increase of production. This seemingly impossible task is nonetheless critical for the ultimate benefit of improved seeds to reach the small farmers. Examples of what can be done to do this are presented below. The list is incomplete and with creative thinking, an infinite number of themes can be promulgated.

1. Encourage farmers to plant at optimum densities and employ good cultural practices. This is, in some ways, a "demonstration" of a low-profile production package, but by combining this with the basic principles of seed production (isolation, rogueing of off-types, special care at harvest, etc.) it would in fact be a first step towards a technically viable seed multiplication at the small farmer level.

2. Encourage small farmers to plant on fields that have recently been fertilized for cotton if they cannot provide fertilizer for the seed production. The "after-effect" of fertilization of cash crops is widely felt to be an economically viable means to provide some fertility improvement to soils planted in food crops. The extension seeds expert would indicate that good production practices will produce seeds of greater vigor, etc.

3. Teach the small farmer that seeds must be handled differently than grain during drying and storage to prevent loss of quality. He would have to work with the farmer to learn the best way to do this under the existing conditions, and would sample at pre-determined times to send to the seed laboratory with the goal to better understand the dynamics of maintaining seed quality at the small farm level (i.e. where problems occur, what special handling is required, etc).

Table 12. Quantities of Multiplied Seed Required at Each Stage in Fourth Project Year (1984)

English	Breeder Seed	1st Multiplication	1st or 2nd Multiplication Foundation Seed	2nd or 3rd Multiplication 1/
Possible French Terminology	Semences "Elites"		Semences de Base	Semences Multipliees 2/
Designation	M0	M1 3/	M1 or M2	M2 or M3
CROP	KILOGRAMS REQUIRED OF QUALITY SEED AT EACH STAGE IN FOURTH PROJECT YEAR			
Peanut	2,150	21,500	215,000	2,150,000
Sorghum (wet Season)	50	--	4,500	405,000
Sorghum (dry season)	44	--	3,280	246,000
Maize	43	--	2,042	98,000
Millet	4	--	390	39,000
Green Manure	P.M.	P.M.	P.M.	P.M.

1/ See Tables 7-11 for Estimated Demand.

2/ To be developed as manpower and resources permit into a "certified" seed program.

3/ Required only for peanuts.

Table 13. Land Requirements (hectares) for Seed Multiplication at the Research Station and the Foundation Seed Farms.

Designation	M0	M1	M2	M1 + M2
Location	IRA-Nord	Seed Farms		Total Seed Farms
CROP				
Peanuts	2.15	21.50	215.00	236.50
Sorghum (wet season)	0.06	5.00	--	5.00
Sorghum (dry season)	0.07	5.50	--	5.50
Maize	0.04	1.70	--	1.70
Millet	0.01	0.49	--	0.49
Green Manure	P.M.	P.M.	--	P.M.
Total IRA-North	2.33 ha			
Total Seed Farms				249.19 ha
Total Seed Farms / 2				124.60

Figure 3. Outline of Peanut Multiplication Procedure

215 kg "Elite II" Breeder Seed from IRA-North

(1)

2150 kg

(2)

21,500

(3)

215,000

(4)

2,150,000 kg. improved seed for identified small farm needs

Step 1: After adaptation testing and/or breeding program, a "handful" of seed is identified for release. This seed is then multiplied by the breeder to supply the Foundation Seed Farm with varietally pure seed.

Step 2: The seed farm increases the breeder seed to have sufficient quantities for planting the required number of hectares of Foundation Seed, and to renew security stock.

Step 3: The seed farm further increases the breeder seed, bags and labels for distribution to extension oriented organization.

Step 4: SODECOTON and other recipients of Foundation Seeds will utilize their respective extension service to supervise this multiplication. The extension seeds expert of the NCSP - Phase II will provide technical assistance to the extension agents and farmers responsible for growing this seed. The seed project will not provide other production inputs such as fertilizer, insecticide, etc. although it may recommend such inputs. The responsibility to supply production inputs reverts to the extension organization or private enterprise.

4. Explain and if possible demonstrate to the small farmer that the improved variety is a better producer than the local variety. For example, improved seed can be demonstrated to emerge faster or a a higher percentage than seed of unknown origin and quality. Or, the improved seed yields better because it is disease resistant, or is drought-tolerant. Finally, after the preliminary lessons are taught, the seeds extension agent will explain that if seeds are mixed then these superior qualities will disappear. However, the farmer has to first understand that some "seed" is different to even be motivated to keep them separate. After all, why do all that extra work if one doesn't believe that it is valuable.

5. Extension materials can be prepared for seeds. A newsletter can be mailed to extension agents. Slide programs can be prepared and production experts consulted for their advice. Mass media can be used as a rapid and entertaining way to heighten the perception of "seeds" in contrast with "grain" used as seed. Work has been started in this area and it must continue to increase in its scope and usefulness to the small farmer.

These suggestions are all possible in the eyes of the team to implement with a minimum of working funds. In some instances, materials available from the Miss. State Seeds Laboratory can be adapted and translated to assist in the seed extension service. Some of the NCSP personnel have this material available and are perfectly capable of adapting and translating it.

4.4 Production, Processing and Storage

Each of the two USAID-funded seed production and conditioning centers will have sufficient production, processing, and clean seed storage capacity to accomodate the foundation seed quantities of the targeted crops for North Cameroon. The facilities are so designed to permit expansion, when the need arises, without affecting the efficiency of the on-going operations. Details are presented in Annex II.

4.5 Cold Storage - Security Stock

Low temperature conditioned storage is necessary to maintain seed for longer than 18 months in North Cameroon. Seed storage during the period of low humidity (November-May) will maintain seed germination and vigor at levels comparable to the quality status of the seed at the beginning of the period (November). However, the period of high humidity (June-October) will create conditions where seeds will absorb moisture from the air and coupled with high temperature this will produce rapid deterioration and eventual death.

The justification for conditioned cold storage is based on two main points. First, in the case of severe crop failure due to climate or whatever, the seed stock in cold storage will be available to plant the

year following the crop failure, and this will allow a rapid recovery in the seed multiplication scheme. For example, in the case of peanuts, if drought conditions cause a 100% seed crop loss, then by planting the 4.3 tons of seed from cold storage the 1st year after the drought, a small quantity of seeds could be distributed the 2nd year after the drought and by the 3rd year after the drought the seed distribution would return to normal levels. If, however, only 2 tons of breeder seed was available for planting after a drought, then no seed would be available for release until the 4th year after the drought when seed distribution would return to normal. This leads us into the second main point.

Breeder seed production during a major drought would also falter. If no breeder seed is maintained in cold storage, the difficulties in returning to full production are far greater - even to the hypothetical "loss" of a developed variety. For this reason, a number of different elite varieties of breeder seed must be kept in cold storage. This has the additional advantage of not requiring the plant breeder to produce small quantities of seed each year.

To maintain the "security stock" in a temperature and humidity controlled environment, a pre-fabricated unit of modular construction can be purchased and easily installed by a qualified local technician. Table 14 sets forth the security stock requirements for the targeted crops. The total required capacity of the conditioned cold storage room is approximately 6 tons. Under these conditions*, the seed should store well for 3-5 years.

4.6 Administrative Feasibility

As indicated in the project background, there are 6 full-time agronomists assigned to the NCSP. All expatriate assistance presently at post is scheduled to leave after the 1980 cropping season.

Reorganization is required to fit the reorientation of the project goals. A preliminary indication of staffing needs to assure administrative feasibility is as follows.

It is estimated that the project will require eight trained seed technologists to be fully staffed, and 3 expatriate advisors (one of the expatriate advisors in not being recommended for USAID funding because of the likelihood that it can be staffed by other interested donors).

One of the seed technologists will be stationed in Yaounde at the seeds testing laboratory. He will be responsible for the daily operation of the lab and as his schedule permits he will provide consulting assistance to seed producers in Cameroon concerning quality standards

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* that is, approx. 50°F and 50% R.H.

Table 14. Security Stock Requirements

CROP	Kgs. Seed Maintained In Cold Storage		
	A 1/	B 2/	TOTAL
Peanuts	4,300	1,290	
Sorghum (wet season)	100	3.4	103.4
Sorghum (dry season)	88	3.5	
Maize	86	3.5	
Millet	8	0.3	8.3
Green Manure	P.M.	P.M.	P.M.
TOTALS	4,582	1,301	5,883

1/ Two times requirement to plant M1.

2/ Requirement to plant M0 for 6 different varieties.

and problems. He will also direct the seed sampling specialists in their travels to collect seed for analysis. At the end of the 5 year sub-project, when seed producers understand sampling techniques and are regularily sending samples to the lab, the position "seed sampling specialists" will be phased out.

Three seed technologists will be stationed in Maroua. One will have overall responsibilities for the foundation seed production farms in the northern province. The other two will plan and implement the training and information programs as detailed in the section Project Description.

Each of the seed farms will be staffed with two seed technologists. One will direct the entire operation and the second will concentrate his activities in the domain of quality control.

In addition to the seed technologists, two other specialists trained to the B.S. or above level will be required. One, a agricultural development specialist, will serve as the Administrative Secretary of the National Seeds Committee and will be located in Yaounde. The second, an agricultural equipment specialist, will be stationed at Guetale and be required to máke periodic visits to the Sanguere seed farm.

The three expatriate advisors are programmed as followed. A agricultural planning specialist will work with the Administrative Secretary of the National Seeds Committee. A seed technologist, quality control expert, will work with the National Seeds Lab. And, finally, an agricultural machinery expert will be stationed at Guetale..

A summary of the personnel needs is presented in Table 15.

As a general comment, the administration of the project should be divided into three distinct operations: (1) production and distribution, (2) quality control, and (3) information dissemination.

Table 15. Summary of Personnel Needs

I. MIDEVIV Headquarters

1. Administrative Secretary of the National Seeds Committee
2. Expatriate Advisor (not funded by USAID)
3. Accountant
4. Secretary
5. Support Personnel

II. Seed Testing Laboratory

1. Chief Analyst
2. Expatriate Advisor funded by USAID sub-project
3. Junior Analyst
4. Seed Sampling Specialists (2)
5. Support Personnel

III. MIDEVIV NCSP - Maroua

1. General Manager
2. Extension Seed Specialists (2)
3. Accountant
4. Secretary
5. Truck Drivers
6. Support Personnel

IV. Seed Production and Conditioning Centers

A. Guetale

1. Manager
2. Asst. Mgr. - Quality Control
3. Plant Superintendent - Maintenance Specialist
4. Expatriate Ag. Machinery Specialist
5. Processing Technicians
6. Sec./ Records Clerk
7. Mechanic
8. Support Personnel

B. Sanguere

1. Manager
2. Asst. Mgr. - Quality Control
3. Plant Superintendent
4. Processing Technicians
5. Sec/Records Clerk
6. Mechanic
7. Support Personnel

ANNEX I

ITINERARY AND APPOINTMENTS

January 11 — Met with Cameroonian Ministry of Agriculture, USAID/C, and FAO officials

Mr. Konga, Direction des Etudes et Project (DEP) du Ministere de d'Agriculture (MINAGRI).
TOZE Emmanuel, DEP/MINAGRI
Mr. Williams, Mission Director/USAID/Y
Mr. David Perkins, Country Rep, Regional Project for Food Crop Protection
Mr. Eric Witt, Rural Development Officer (RDO)/USAID/Y
Mr. Dick Goldman, Asst. RDO/USAID/Y
Mr. Gary Bittner, National Seeds Service/USAID/Y
FONGYEN Adam David, Asst. Director (MIDEVIV);
Mr. Gara, Country Rep./FAO/Cameroon

January 12 — Briefing by Gary Bittner and review of documents

January 13 — Travel to Garoua. Discussions with USAID and North Cameroon (NorthCam) Seed Project Personnel. Visit to Sanguere Seed Farm. Chance encounter with IRA-Nord Director.

BINDZI - TSALA Joseph, Director/Institut de Recherche Agricole-Nord (IRA-Nord)
LONTCHI Christophe, Seed Specialist/North Cam Seeds Project.
Mrs. Ans Burgett, Extension Expert/USAID/Garoua
MBOLDA Pierre, Sanguere Farm Manager/North Cam Seeds Project.
TOZE Emmanuel, DEP/Yaounde

January 14 — Met with Provincial officals. Discussions with CPLS, Office Cerealier, SODECOTON, and CENEEMA personnel.

ANGOKAY Sadjo, Secretaire General de la Province du Nord. GARGA Yaya, Director du Comite Provincial pour la Lutte contre la Secheresse (CPLS).
Mr. Evrard, Technical advisor to CPLS and to the Division Economique du Minister de l'Economie et du Plan/FED/Garoua
Mr. A.I.D. Barker, Storage Expert/Office Cerealier/FAO/Garoua; Director/SODECOTON
Mr. Ernst Van Der Heide, Director (CENEEMA)

January 15 — Travel to Maroua. Met with administrative officals. Working Session with North Cam Seed Project and IRA-Nord Personnel.

ELANG Joseph, Coordinator/Seed Project
NJOMGUE Seraphin, Agronomist/Seed Project
MOUSSID-DIKOUME Ferdinand, Extension Specialist/Seed Project
NJOPKOU Emmanuel, Seeds Specialist/Seed Project
Mr. Kevin Wiedmann, Machinery Specialist/Seed Project
TOXE Emmanuel, DEP/Yaounde
BINDZI-TSALA Joseph, IRA-Nord

January 16 — Travel to Moulvouday and Yagoua area. Visited Young Farm Family Training Centers at Moulvouday and Dadjamka. Interviewed technical leader at the Semry Project in Yagoua. Visited the Seed Farm at Dadjamka. Met with administrative officials.

Director YEFTC/Moulvouday;
Asst. Director YFFTC/Dadjamka;
Mr. Marcel Lombardo, Technical Leader/SEMRY;
Dadjamka Farm Manager/Seeds Project
TOZE Emmanual, DEP/Yaounde

January 17 — Working meetings with IRA-Nord (a.m.) and Seeds Project (p.m) personnel. Visited reserch station at Giuring.

BINDZI-TSALA Joseph, Director/IRA-Nord
Mr. Owen Gwathmey, Research Specialist, SAFGRAD Project
Seed Farm Personnel
TOZE Emmanuel

January 18 — Visit to Mokolo and the Seed Farm at Guetale. Met with administrative officials. Returned to Maroua and prepared initial draft of technical background information.

January 19 — Travel to Garoua for meeting with Ministry of Agriculture representative for the North. Presented paper on preliminary recommendations and technical observations of study.

YAYA Garga, Presiding/CPLS
GOURLEMOND Gilbert, Delegate of the Provincal Department/ MINAGRI/Garoua
TOZE Emmanuel, DEP/Yaounde
Mr. Gary Bittner/USAID/Y
Mrs. Ans Burgett/USAID/G
NJOMGUE Seraphin, Seeds Project
LONTCHI Christophe, Seeds Project
MBOLDA Pierre, Seeds Project
Mr. Kevin Wiedmann, Seeds Project
Dr. MBON Ruben, Director/Office Cerealier
Mr. A.J.D. Barker, FAO/Office Cerealier
BRUSON Herve, SODECOTON
DAND Go'o, SODECOTON

January 20	Sunday (free-time)
January 21	(08:30) - January 23 (12:00)
	Seminar on Seed Production, Storage, Drying and Quality Control (approx. 30 participants)
January 23	Return to Yaounde
January 24	Consultation on experiences and recommendations among MSU team. AID briefing 1600-1800.
January 25	Departure of Vaughan to USA. Initial contact with equipment supplier in Yaounde. Review of documents.
	Mr. Patrick HUALDE, hamelle afrique/Yaounde
January 26-27	Saturday and Sunday (free time)
January 28	Discussions with USAID/Y personnel and preparation of initial draft, equipment lists, etc.
January 29	Second contact with agricultural equipment supplier in Yaounde, discussions with USAID/Y personnel and preparation of initial draft of report.
January 30	Working sessions at the Ministry of Agriculture (DEP) and MIDEVIV. Arrival of FAO Seeds expert.
	Mr. KONGA, Direceur/DEP/MINAGRI Mr. OLE, Asst. Directeur/DEP/MINAGRI Mr. TOZE, Expert/DEP/MINAGRI Mr. ABONG, Director/MIDEVIV Mr. FONGYEN Adam David, Asst. Director/MIDEVIV Technical Advisor/MIDEVIV
January 31	Preparation of report (am) and working session with MIDEVIV (pm). Departure of Beck to USA.
February 1	Preparation of Report
February 2	Preparation of Report
February 3	Free time (Sunday)
February 4	Interview with World Bank technical advisor to the DEP, preparation of initial document, and detailed briefing of USAID/Y personnel and the FAO Seed expert.
	Mr. Dela Taille Mr. Bellon

February 5	Reusche travels to Abidjan.
February 6	Meetings with REDSO procurement specialists to investigate availability of small capacity peanut processing machines not available in USA.
February 7	Departure Reusche to USA.

ANNEX II

General List Of

Additional Equipment Required

The equipment required for production (tractors, plows, etc.) will continue to be purchased from firms operating within the country to assure a readily available source of repair parts and service. Standardization of equipment, which is most desirable, can also be accomplished as present equipment is supplemented or replaced by additional units.

After harvest and prior to distribution, the sequential movement of the harvested seed is drying, bulk storage, processing and warehouse storage. Since 95% or more of the seed production will be peanuts, the two seed installations must be basically equipped to handle peanuts. Until other crop production increases drastically the seed processing equipment presently on hand is adequate for these small quantities.

Peanut harvesting is a multi-step practice made up of several separate operations. Harvesting practices are among the most critical in peanut culture because of their far-reaching effort on yield, quality and total worth of the seed crop. Maturity of the peanut determines digging time. In modern harvest procedures, digging, shaking and windrowing is done in a single operation. To assume a timely harvest two additional peanut digger-shakers and a peanut combine are recommended for each location.

The digger-shakers should be adjusted in the field so that the flat-running blades clip the tap roots just below the pod zone. The shaker speed can be adjusted to provide adequate agitation to remove soil as the vines are lifted from the row.

After the pods and kernels have air dried to approximately 20 per cent moisture in the windrow they should be combine harvested directly from the field. Whole plants interlaced as a ribbon are lifted and taken into the combine where pods are removed, cleaned, stemmed and conveyed into a bulk bin on the combine. Remaining plant matter is discharged back onto the field for organic value. The bulk bin on the combine is dumped hydraulically. These high moisture content seed must be dried artificially under controlled conditions to retain maximum seed quality.

The proposed drying system consists of four 14 ft. drying trailers and two trailer driers equipped with 10 HP fans and designed to dry two trailers simultaneously. The trailers which are equipped with perforated floors and air plenum chambers can be taken directly to the seed production fields where they are loaded from the bulk bin of the combine.

The loaded trailers must be taken immediately to the processing site where the drying fans are located. The plenum chambers of the drying trailers are connected to the fan by means of canvas ducts. During the drying operation a competent technician must monitor the air flow and moisture content to assure drying and prevent damage to the seed. After drying, the bulk dry seed in the trailers is either taken directly to processing for cleaning, etc. or to a bulk storage warehouse where it will be kept safely until it can be processed.

This trailer type, bulk drying system is used almost exclusively to dry peanuts in the U.S. both for seed and for commercial use. The drying trailers can be easily utilized to dry other type seed crops as well as being available for use as a conventional 4-wheel trailer when not needed for seed drying.

Peanut cleaning and sizing require heavy duty specially designed equipment. A Hobbs Model 488 cleaner is recommended for each location. This machine is a small heavy duty industrial cleaner, available in the U.S. commercially, that incorporates a number of individual systems to perform the following cleaning operations: separate sand, dirt and fine trash; scalp off sticks and other foreign material; separate seed relative to specific gravity; separate seed or material relative to size; remove stones and other heavy material; and separate aspirated material from the air stream.

After cleaning the unhulled peanuts are bagged and treated with an insecticide for safe storage in a bag storage warehouse. The seed production for the "security stock" should be placed immediately in the low temperature conditioned store room.

A general list of additional equipment required for each farm follows this narrative. It is noted that an inventory of the equipment actually in place at the two farms was not available to the consulting team. Total costs per farm amounted to $67,150, or $134,300 for the two farms. If 40% is assumed for crating and shipping, the cost increases to approximately $190,000.

Finally the prefabricated, modular type construction, refrigerated storage unit for storage of the security stock, and the refrigeration and dehumidification equipment required are estimated to cost a total of $13,700 FOB Supplier.

Notes:

(1) Since electric power will be required for the drying fans, processing equipment and temperature/humidity control equipment, as well as for lighting and auxilliary equipment, it is essential that electric power be available at both sites, Guetele and Sanguere. The horsepower requirements for the various units of equipment are included in the list of equipment that follows. (The electric power generating units should be purchased from a firm operating within the country - electrical characteristics of motors can be ordered to match the electric power plant).

(2) Tractors and other farm equipment needs should be evaluated by a farm equipment specialist.

(3) The recommendation of peanut combines is not without some reservations. A study needs to be undertaken to assess harvest and thrashing methods that are feasible with particular emphasis on equipment manufactured in Africa (Senegal) and proven techniques in the African context.

(4) All prices indicated are F.O.B. the manufacturere. Thirty to forty percent should be added to these prices for crating and shipping costs.

General List of Additional Equipment Required for Each Farm. Explanation of Use, Electrical HP Requirement and Estimated Cost.

Item No.	Item	Electric HP	Est. Cost US $ FOB Supplier USA
1	Peanut digger-shaker, three units, for harvesting peanut seed (3 units @ 1,800)		5,400
2	Peanut combine, two units, for separating peanuts from vines (2 units @ 13,500)		27,000
3	Drying trailers, four units, for transporting and drying seed (4 units @ 1,500)		6,000
4	Drying fan, two units, for drying seed in two trailers (2 units @ 2,500)	20	5,000
5	Bucket elevator, high capacity for feeding uncleaned peanuts to peanut cleaner.	1	3,000
6	Peanut cleaner, for cleaning and sizing unshelled peanuts	5	6,600
7	Bucket elevator, for lifting cleaned peanuts to bagging bin	1	2,000
8	Bagger, semi-automatic, for filling and weighing bags of cleaned peanut seed.		1,800
9	Shop equipment and supplies (air-compressor, welder, grinders, drills, wrenches, jacks, etc.) for repair and maintenance of equipment.	10	3,000
	Sub-total		59,800
	Miscellaneous (spare parts, omitted items, etc. - 10% of total)		7,350
	Total		$ 67,150

ANNEX III

JOB DESCRIPTION
FOR
SEED PROCESSING ENGINEER

1. Position Ojective

To provide guidance and technical assistance to the NCSP in the installation of seed processing machinery and training of operators for two seed processing/storage centers. To develop a system for managing and coordinating the various operations in the multiplication of seeds produced by the foundation seed farms for processing at the centers that will be operated by the NCSP. To cooperate with GRUC, USAID and FAO personnel in the planning and implementation of training activities.

2. Responsibilities

a. Direct and assist in the installation of the seed processing and related equipment at the two seed processing centers to be constructed during the period of the assignment.

b. Develop a cadre of Cameroonians that will meet the seed production and processing needs of the NCSP by giving on-the-job training and to assist in selecting candidates for United States and third country training.

c. Be responsible to the General Manager of the NCSP and coordinate all seed processing/storage activities with the USAID Project Team Leader.

This position will require a person with training in seed technology associated with seed processing/storage. He must be mechanically inclined and have the ability to teach others the principles of seed processing/storage and the skills to manage and operate the processing/production equipment.

A. Training

The minimum level of technical training should be a B.S. degree in agricultural, industrial or mechanical engineering.

B. Experience

It is recommended that the person filling this position have had extensive experience in the installation and operation of seed processing/production equipment, preferably with two or more years experience working in developing countries.

C. Travel

During the installation of the first processing/storage facility (approximately 6 months) little travel will be involved; however, extensive local travel with in North Province will be required during the remainder of the assignment.

D. Language

French proficiency is desired. An ability and committment to learn French is required.

JOB DESCRIPTION

FOR

SEED QUALITY CONTROL SPECIALIST

1. Position Objective

To provide guidance and technical assistance to the National Seeds Committee in the iniation and development of a comprehensive quality assurance program. This will include the installation of seed testing equipment and the training of analysts in the National Seeds Laboratory in cooperation with the Cameroonian Chief Analyst, periodic consulting trips to seed production and processing sites, and the development of operational procedures for both the national level and the foundation seed production centers in operation.

2. Responsibilities

a. Assist in the installation of the seed testing equipment at the National Seeds Laboratory to be constructed during the period of the assignment.

b. Develop a cadre of Cameroonian analysts capable of independently running routine seed quality tests, and in accurate reporting of the results of the tests to the interested parties.

c. Be responsible to the Cameroonian Director of the National Seeds Laboratory and the USAID Project Manager.

d. Develop a system of regular field inspections at all locations where breeder and foundation seed are grown.

e. Establish a system to monitor seed quality during all phases of production and conditioning at the foundation seed farms.

f. Participate with GRUC, USAID and FAO personnel in the planning and implementation of training activities.

g. Establish a system of regular inspections of all seed destined for distribution to seed utilizers with the objective of assuring that the labeling is accurate and that minimum quality standards are adhered to.

This position will require a person with training in seed technology associated with quality assurance, seed production, seed sampling, and seed laws. He must be capable of performing both the routine and specialized seed tests, and have the ability to teach others the priciples of seed testing.

A. Training

The minimum level of technical training should be a B.S. degree in seed technology with at least 3 years relevant experience, or a M.S. degree in seed technology.

B. Overseas Experience

Overseas experience in a French-speaking country is desirable.

C. Travel

Extensive in-country travel is expected during the entire assignment.

D. Language

A minimum French proficiency of S2/R2 is required with a committment to achieve a S3/R3 after the first year on-the-job.

ANNEX IV

In general, the recommendations and project orientation presented in the main text of this report should be implemented during the interim period, to the extent possible with available staff and financing. The document represents the minimum effort required for a viable seeds program in the north province. During the interim positive steps must be taken to reorganize the project and purchase essential equipment.

Some suggestions to do this with limited budgeting are presented below as a basis for discussion. The final decisions concerning the interim period must be made after funding levels are determined and in consultation with all interested parties.

Suggestions for interim period:

1. NCSP activities should be concentrated at Guetale. At Sanguere, the seed production program should be limited to approximately 50 hectares under a contract arrangement with CENNEMA. All tractors and implements should be transferred to Guetale. The rest of the Sanguere hectarage should be planted and maintained as a green manure crop.

2. Guetale should be provided with the essential equipment inputs for the interim period. The various buildings should be renovated and the snakes chased out of the garage. The residences should be studied for possible renovation. Electricity and adequate water must be provided.

3. A meeting with potential electric users in Guetale should be held and an agreement for cooperative use of the facilities agreed on.

4. One or more project technicians should be trained to the M.S. level in seed technology.

5. The project direction must be re-organized with quality control, information dissemination, and production as separate functions. Two agronomists should be stationed at Guetale.

6. The Agricultural Machinery Equipment Expert should be retained and given the means to work and transferred to Guetale.

7. GRUC should purchase all equipment required during the interim. to allow rapid procurement. Ideally, AID assists with local currency funds and training.

8. Project should conform to Phase II strategy to the extent possible.

9. Contract with IRA-North for breeder seed and technical assistance.

10. Come to agreement with GRUC about peanut specialist at IRA-North.

11. All seed distributed must be tested, labeled, and within defined minimum quality standards.

12. Plant only seed of certain origin, known to be adapted to region.

13. Short term technical assistance should be provided for start-up of viable quality control program.

14. Short term technical assistance should be provided to assist GRUC in determining essential equipment needs for Guetale during the interim.

15. Two way contact should be pursued with SODECOTON to prepare the modalities of interaction for the future Center-North project.