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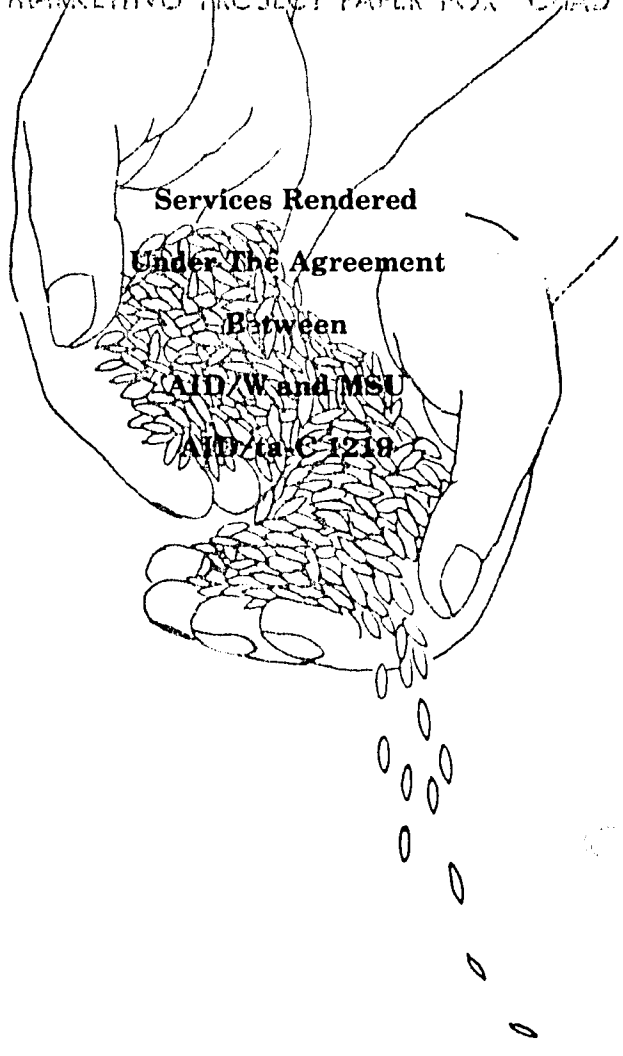
SEED MULTIPLICATION SUB-PROJECT OF THE AGRONOMIC RESEARCH, SEED MULTIPLICATION AND GRAIN MARKETING PROJECT PAPER FOR CHAD



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SEED TECHNOLOGY LABORATORY
MISSISSIPPI STATE UNIVERSITY
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REPORT SUMMARY

TITLE: Seed Multiplication Sub-project of the Agronomic Research, Seed Multiplication and Grain Marketing Project Paper for Chad.

CONTRACT NO: Mississippi State University - AID/ta-C-1219

CONSULTANT: H. Dean Bunch

PERIOD IN CHAD: November 9 - December 7, 1977

Services were requested under the referenced MSU/AID Contract to provide one consultant to assist in the preparation of the Seed Multiplication Sub-project of the three-part project paper. Other consultants assisted with other portions of the main project.

Although not in final form at the end of the consultant's TDY, this report left with USAID/Chad contains the necessary technical elements for incorporation into the project paper.

The report is concerned primarily with the detailed technical aspects of the proposed Seed Multiplication Sub-Project. The procedure for multiplying improved seed of superior varieties is explained, the organizational structure outlined, and implementation schedule presented. Success of the project is premised on some major assumption which are listed and discussed. Finally, lists of required equipment are given, along with suggestions for obtaining assistance in the preparation of equipment specification and installation plans.

SEED MULTIPLICATION SUB-PROJECT
OF THE
AGRONOMIC RESEARCH, SEED MULTIPLICATION
AND GRAIN MARKETING PROJECT
FOR CHAD

BACKGROUND

The Development Assistance Program (DAP) prepared for Chad in 1975 suggested seed multiplication as a method of improving the productivity of the traditional food crops. The Direction de L'Agriculture has estimated that the yields of millet and sorghum can be increased by 20% by the use of improved varieties and disinfection. A seed multiplication component was included in the Project Identification Document (PID) and further elaborated in the Project Review Paper (PRP). Both papers were approved. The sub-project herein proposed has the same goals and objectives as those proposed at the above-mentioned earlier stages.

There is no organized national effort in developing and implementing a seed improvement and distribution program. No professional personnel of Chad has had training or experience in production, processing, quality control, promotion, or distribution of improved seed.

This project is highly dependent on the research component of the present project proposal and through it with IITA, ICRISAT, SAFGRAD, IRAT and other international research centers for developing superior varieties adapted to Chadian conditions. The project is closely linked with the FAO contribution in seed multiplication, which consists of the services of one technician and some operating funds.

With the exception of small quantities of imported seed during periods of drought,

seed used by Chadian farmers are characterized as follows:

1. The seed used for planting are generally saved by the farmer from his own grain production.
2. The seed are largely of unknown germination potential and purity and of uncertain varietal identity.
3. The better grain is sold by the farmer or consumed, thus leaving the poorer quality grain for use as planting seed.
4. Poor storage conditions and practices further reduce the quality of seed saved for planting by allowing it to get wet or be damaged by rodents and insects.
5. A significant number of farmers periodically buy or barter for their seed supplies in the local grain markets.

The combined effect of these practices reduce the quantity and quality of seed available for planting the next crop.

DESCRIPTION

The purpose of the seed multiplication sub-project is to increase productivity by providing farmers with adequate quantities of improved seeds at reasonable prices. Higher productivity is one of the keys to greater food crop production and increased income for food crop producers. The aim of the seed multiplication sub-project, thus, will be to develop a system of production and distribution through which improved seed of superior varieties, strains, or selections will be multiplied and distributed to farmer users.

Basic to the effective production of seed is the establishment of centers for the multiplication of improved seeds and a national office of coordination. Three Seed Multiplication Units (Centers) will be established on Ministry of Agriculture experimental

research farms at Dougui in the Sahel region, Deli in the Sudanian region, and on a sub-station at Bilram Oursi in the Sudan region. A national coordination office, the Division of Seeds, and a National Seed Testing Laboratory will be established in N'DJamena. Seed will be produced on the experiment station farms by the Seed Multiplication Units and, when land or labor becomes insufficient, with contract seed growers. Improved seed thus produced will be distributed by ONDR, the national extension service.

Inasmuch as there are no appropriate facilities at any of the locations, except for a drying floor at Dougui, the provision of buildings and basic equipment will constitute a large portion of the inputs of the project. Several levels of training will be supplied, as well as services of short-term consultants.

LOGICAL FRAMEWORK SUMMARY

To achieve the sub-project purpose which will contribute to the program goal, the following conditions will prevail at the end of the sub-project period. (Hereafter, the term "project" will refer to "sub-project-seed multiplication".)

End of Project Status

1. The area planted with improved seed by small farmers during the project period increased from 0 to 90,000 hectares, enough to produce 70,000 metric tons of food grain. An examination of ONDR seed distribution records gave an approximation of areas planted.

2. Average yields of sorghum, millet, peanuts, rice and corn planted from project-improved seed increased by 20 percent. This was established by a comparison of yields of farmers using improved seed with those of farmers continuing with local seed.

3. Seed costs to the farmer was no greater than non-project-improved seed per unit of grain produced. A simple sampling of ONDR sales records and current open

market prices confirmed this.

Attainment of these end-of-project conditions is based upon some major assumptions, one is that the government will make a strong commitment to the program. Commitment will be evidenced by (1) creating an office under the Directorate of Agriculture solely concerned with coordinating the various activities essential in attaining a high level of effectiveness in the seed program, including seed quality control and personnel training; (2) establishing and supporting a strong research program to develop genetic stocks of superior crop varieties; (3) assigning the responsibility for promoting the use of improved seed for distributing the seed to farmers, and strengthening the ONDR so that it can perform these functions effectively; and (4) developing methods and procedures for financing the multiplication of seed, particularly that produced by contract growers. Other important assumptions are that (1) farmers will accept, and be willing to purchase, the improved seed when available, (2) other agricultural inputs will be available in order to maximize the value of the improved seed, and (3) adequate personnel for manning the project will be available for training.

Outputs

1. A combination Foundation Seed-Seed Multiplication Unit was established at Dougui during year 1, another at Deli in year 2, and a Seed Multiplication Unit only at Biliam Oursi in year 3. All became operable on schedule.

2. In year 5, the project produced 1000 metric tons of improved seed of millet, sorghum, rice, peanuts and corn. This is the capacity for which the installations were designed and is the rate of production expected in subsequent years. While the project was growing to this size, 500 tons of seed produced in years 3 and 4 resulting in the 70,000 metric tons expected by the end of the project.

3. Seed produced by the Seed Multiplication Units were distributed to farmers by the ONDR, the national extension service. Enough seed was distributed to plant over 90,000 hectares during the project period. Based on an average farm size of 2.5 hectares, the improved seed satisfied the needs of 36,000 farmers. (The following table gives the basis for production projections.)

4. Technicians were trained in seed production and other essential areas of seed technology. The Director and Associate Director of the Division of Seeds received training in the U. S. One person working with field inspectors and each manager of the Seed Multiplication had training in another African country. Local training was conducted by the Division of Seeds for seed analysts, field inspectors, contract growers, and ONDR personnel for a total of about two hundred persons.

5. The National Seed Testing Laboratory was established within the Division of Seeds at N'DJamena as a national seed quality control agency and tested about 2000 seed samples in year 5.

Critical assumptions in attaining these outputs an that physical facilities are completed on schedule and that trained personnel will have completed training and are on the job. These conditions must be achieved if production expectations are reached. Even if production goals are reached, ineffective promotion and distribution systems could be serious impediments to usage of improved seed by the farmers.

Basis for Output Projections

Crop	Planting Rate kg/ha	Yield (Kg/ha)		Reproduction Factor	
		Country Average (1)	Improved Seed (Ave.+20%)	Country Average	Use of Improved Seed
Millet and Sorghum	8	540	648	68	81
Rice (Paddy)	35	1,250 (2)	1,500	36	43
Peanuts	60	450	540	8	9
Corn	20	1,200	1,440	60	72

(1) Yields of millet and sorghum, rice and peanuts were calculated from hectarage and production in the Club des Amis du Sahel, Rapport de Synthese. Situation de l'Agriculture en 1975-76.

(2) In the South only.

Formulae:

1. To calculate the number of hectares that a given amount of seed will plant: Amount of Seed (kg) ÷ planting rate (kg).

2. To calculate the number of metric tons of grain that a given amount of seed will produce: Amount of seed (MT) X Reproduction Factor or Number of Hectares X Yield.

Inputs

1. Personnel Services. Ten-person months of short-term consultants were provided. The consultants were utilized in program planning and implementation, installation of equipment, and in local training courses on inspection, testing, use of equipment and seed handling.

2. Training. Two participants received academic training at the M.S. level in the U.S. for the two top positions in the Division of Seeds. The training program included seed program development, seed production, seed processing, seed physiology, and seed testing. Four were trained in a third country in seed production under less-than-optimum conditions. After training, these technicians became managers of the three Seed

Multiplication Units, and one worked in the Division of Seeds in connection with seed quality control. (Approximately 200 persons received local training.) Target groups were technicians in the Seed Multiplication Centers, contract growers, field inspectors, seed analysts, and ONDR personnel. Those who received out-of-country training were the principal trainers and were assisted by consultants, research personnel and ONDR technical leaders.

3. Commodities. One 10-ton truck was provided for the Seed Multiplication Units in Deli and Biliam Oursi (FAO provided a truck for Dougui). One Land Rover-type vehicle was supplied for the Division of Seeds. Additionally, nine motorbikes (Mobilette-type) were distributed as follows: one each to the Seed Multiplication Units and six to the Division of Seeds. The trucks provided means for transporting seed to, from, and within the Seed Multiplication Units; the motorbike at each Unit was used to transport personnel to and from fields of contract growers. The Land Rover-type vehicle provided transportation for personnel in the Division of Seeds as they coordinated project activities, conducted training activities, and supervised quality control. The motorbikes were used by field inspectors, two of which were stationed near each area of seed production.

Equipment for cleaning, treating, testing and storage of seed was provided to each of the Seed Multiplication Units. Seed testing and other quality control equipment were supplied to the National Seed Testing Laboratory. The equipment was edequate, but minimal, to achieve the planned outputs of improved seed of higher quality.

4. Other Costs. Buildings were constructed in each of the Seed Multiplication Units for equipment and seed storage, including offices. A building was constructed in

N'DJamena to house the National Seed Testing Laboratory, including offices for the staff members of the Division of Seeds. As with equipment, these buildings were essential inputs for obtaining the outputs.

Funds were supplied for operations and required supplies. The poor monetary situation in the country made this a necessity. Without operational funds, the seed multiplication system would have been non-functional.

Project evaluation was conducted at the end of the first and fourth years of the project.

Critical assumptions are that (1) services of consultants can be obtained when needed, (2) the candidates for training are available and after training are placed in positions for which they were trained, (3) the costs of the equipment and buildings do not exceed the estimates and (4) that the Government of Chad will have adequate funding for salaries and program.

TECHNICAL ANALYSIS AND DETAILED DESCRIPTION

The plan of the project is to establish a workable seed multiplication and distribution program, utilizing those necessary organizations and facilities which are available and supplying the necessary inputs that are not present. The presently available organizations are two government research stations at Dougui in the Sahel and at Deli in the South and two or more substations which have been designated as seed multiplication stations. There is a minimum amount of farming equipment at each location but no equipment for use in processing and storage of seed.

In addition to the inadequacy of facilities, the low level of operating funds and lack of trained staff, has prevented the development of a strong plant breeding program and subsequent seed multiplication effort. During the past year the situation has improved at

the Dugui station where FED built some basic buildings and FAO has supplied one technicic and limited operating funds, yet, a seed drying floor is the only facility which can be used in a seed multiplication program.

Vehicles, equipment and buildings to be supplied under the project are minimal, but necessary. Equipment types specified are being used successfully in other developing countries under similar circumstances. Buildings will be of masonary type commonly constructed within the country.

The seed multiplication project will both complement and be complemented by FAO contributions at the Dougui station. Since planning was accomplished in coordination with FAO representatives, no duplication of efforts is envisioned.

Location of Seed Multiplication Areas

A combination Foundation Seed-Seed Multiplication Unit will be established at both Deli and Dougui. The responsibility of the Foundation Seed Unit at Deli will be to increase seed of superior varieties from the plant breeding research and introduction program at the Deli research station. It is assumed that varieties developed here would be used largely in the South.

The responsibility of the Foundation Seed-Seed Multiplication Unit at Dougui will be parallel to that of Deli, but for the Sahel region. The Units at each location will multiply seed for ultimate distribution to farmers through the ONDR (Extension) system. Where land, personnel or other inputs are not available to handle the required production, the Seed Multiplication Units will contract with farmers, or farmer groups, to produce the required kinds and amounts of seed. All seed production, whether by the Units or by contract growers, will be processed, bagged and stored in facilities of the Seed Multiplication Units until time for distribution. The Unit Dougui will be established during the

first year of the project, while the one at Deli will be in the second year.

It is anticipated that in the third year of the project, another Seed Multiplication Unit will be established at Biliam Oursi which will be linked to the Deli Unit as a source of foundation seed and technical assistance.

The project varies slightly in operational form from that described in the PRP, where one Foundation Seed Unit was to have been established at Deli, and one Seed Multiplication Unit each at Dougui, Moussofoyo and Bilam Oursi. The present plan takes into account the research and seed multiplication program project already established at Dougui for the Sahel with support from FAO. Rather, than to suggest dissolution of that foundation seed project, which is based on the research program there, it appears prudent to recognize the program for the purpose for which it was established and to support it. The project plan recognizes the necessity for a close relationship with a source of scientific personnel in its early stages. With the first Seed Multiplication Unit in the South located at Deli in conjunction with the research station, supervision can be provided by a USAID agronomist on the research project in much the same way that the Dougui unit has the services of an FAO agronomist.

Establishment of a Division of Seeds

During the third year of the program, the Ministry of Agriculture will establish a Division of Seeds to coordinate production and marketing of improved seeds of superior varieties. This will not be a producing unit. The Division of Seeds will have two types of responsibilities: (1) that of coordinating release, production and marketing of improved seeds and (2) that of operating the quality control activities. All seed production programs in the country, those in this project and any other project, will be coordinated under the Division of Seeds.

The Division of Seeds will be organized under the Directorate of Agriculture and be headed by a Director and an Associate Director. The Director will be advised on matters of policy by a Policy Advisory Committee and on technical matters by a Technical Advisory Committee. The attached organizational chart shows the relationship among these named units and to the seed producing units. A description of the organizational structure and its components follows:

Policy Advisory Committee

Membership to include, but not necessarily limited to:

Director of Agriculture, Chairman

Director of Agricultural Services (Research)

Director of ONDR (Extension Service)

The Policy Advisory Committee will be related to the seed program in terms of national policy decisions concerning seed and crop production, marketing, price stabilization, subsidies, responsibilities of organizations, and any other matters of government policy which effect seed multiplication and distribution.

The Technical Committee will be composed of working professionals who by nature of their work and responsibilities will be able to offer valuable counsel to the Office of the Division of Seeds:

Technical Advisory Committee

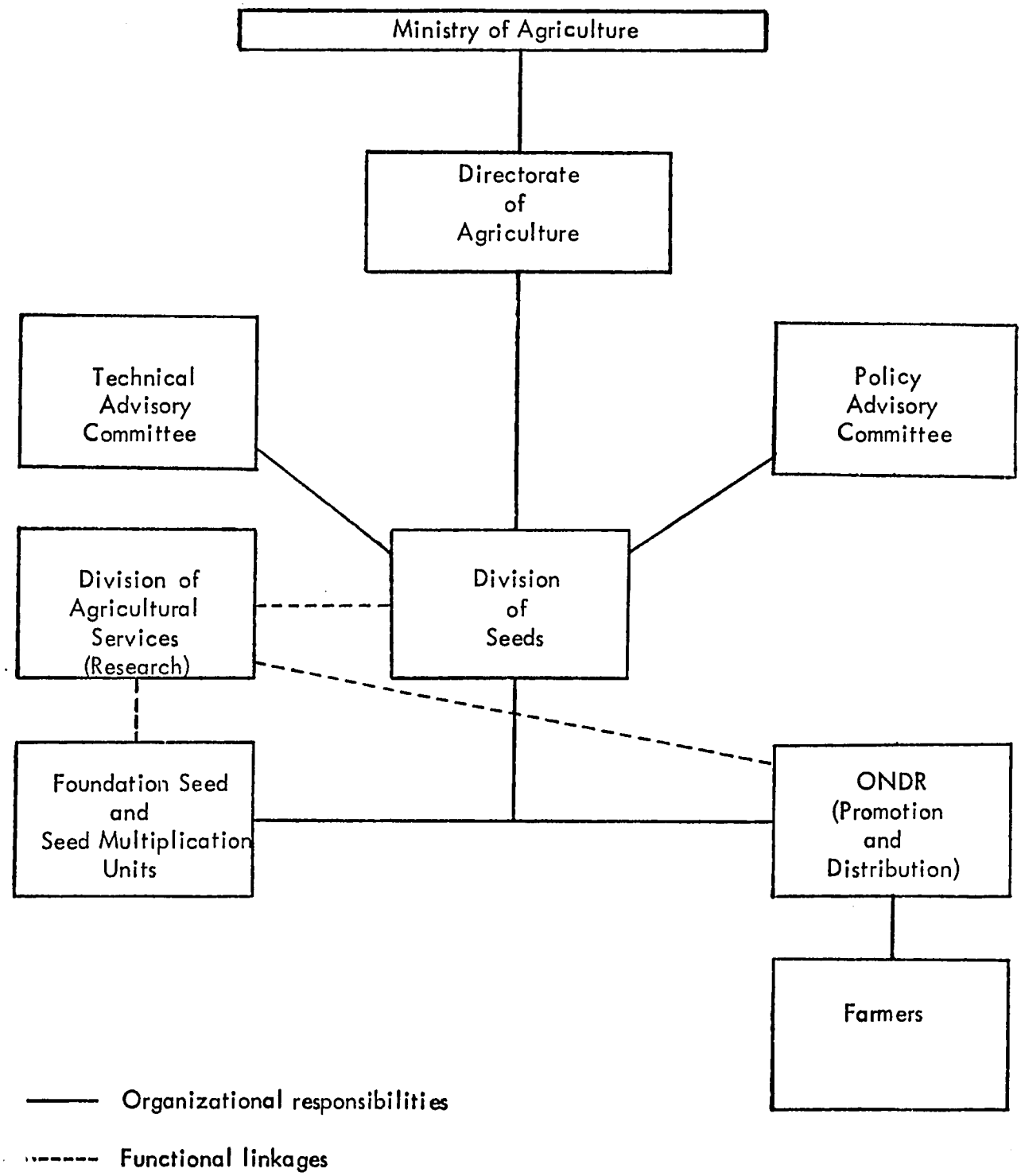
Membership will include, but not be limited to, representation from:

Department of Agricultural Services (Research)

ONDR (Extension Service)

Research Stations at Deli and Dougui

ORGANIZATIONAL CHART
OF THE
SEED MULTIPLICATION PROJECT



This Committee will be concerned with any matter on which the Director of the Division of Seeds indicates, but its principal functions will be: (1) to determine which varieties should be produced and distributed under the program; (2) to determine which varieties should be dropped from the program; (3) to estimate future demands in specific areas for the multiplication units; and (4) to approve quality field and laboratory standards for production and distribution.

The Director should be an agronomist, preferably with major study in seed technology, and will direct or coordinate all activities relating to seed within the framework set forth by both advisory committees. He will provide liaison service between the research organizations and the production units and will coordinate all other activities affecting the national seed program. He will be responsible for directing or coordinating training activities and will work closely with ONDR personnel in conducting demonstrations, and other programs concerned with promoting the use of good seed.

The Deputy Director will head the Quality Control Section of the office. This person should have specialized training in the field of seed technology, with emphasis on quality control in general and seed testing in particular. He will be responsible for developing practical seed standards for the production fields (isolation, mixtures, etc.) as well as seed marketing standards (germination, purity, etc.) for consideration and approval by the Technical Committee. Upon approval of the standards, he will be responsible for identification, sampling, analysis and labeling seed lots produced and offered for distribution.

The Seed Multiplication System

Although it is not envisioned that a seed certification program will be developed within the time frame of this project, the multiplication system will utilize some important

elements of a seed certification scheme. Specifically, the system will be based upon the identification and maintenance of the several generations of seed reproduction or multiplication. At some future time when exceptionally superior varieties have been developed and adequate personnel have been trained and experienced, a certification program can be organized and administered through the Division of Seeds with slight modifications. Until that time arrives, seeds approved through the system should be referred to as "improved seed", "inspected seeds", or some other appropriate name other than "certified".

The generations of seed produced during the multiplication process will be identified as M (Multiplication) generations as described below:

M_0 - Breeder's of Genetic Seed (directly from the plant breeder).

M_1 - The first multiplication of genetic seed (foundation or basic seed).

M_2 - The first generation increase of M_1 seed (or the second multiplication of M_0 seed).

M_3 - The first generation increase M_2 seed (or the third multiplication of M_0 seed.

Normally, the M_3 will be the generation for farmer use, however, either M_2 or M_3 generation could be distributed to farmers, depending upon the type of seed, supply, demand, or other applicable situations.

Before a variety can be approved for multiplication and distribution, it must have been field-tested under performance trials by a research organization to ascertain adaptability to growing conditions and acceptability by consumers in comparison with locally-grown material. After examining the data, the Technical Committee may approve or disapprove the release and multiplication of the variety. If approved, the appropriate

research station, Deli or Dougui, will be responsible for maintaining a stock of M_0 class seed for further multiplication.

These same stations also will multiply the M_0 seed to the foundation seed class (M_1). The foundation seed thus produced will be further multiplied (to M_2) in the Seed Multiplication Unit at each location under guidelines set forth by the Division of Seeds. Where multiplication to the M_3 class is required, these same Seed Multiplication Units can produce some on station land or with farmer contract growers through coordination with the Division of Seeds and ONDR. In the third year of the program an additional Multiplication Unit will be established at Biliam Oursi - for the purpose of multiplying M_1 seed from the Foundation Unit at Deli to the M_2 and M_3 generations both within the Unit and with contract growers. All classes of seed will be returned to one of the three multiplication units for processing, bagging and labeling. Distribution to the farmers will be the responsibility of ONDR.

In the early stages of the program there will be necessary shortcuts. For instance, it will take sometime before the research and introduction programs can develop or locate superior varieties, therefore, early seed improvements will rely upon the research station to select and multiply the apparent "best" from local varieties, and make sure that seed distributed is properly processed and treated and that it will germinate when planted.

Field and laboratory purity and quality standards will be established but will not be so high as to be unattainable under the prevailing production and distribution conditions. Each Seed Multiplication Unit will have a small seed testing laboratory for checking quality of its production, while the National Seed Testing Laboratory organized within the Division of Seeds will conduct the official tests for purposes of labeling the seed lots.

The Distribution System

The chief responsibility for distributing improved seed produced by the Multiplication Units will rest upon ONDR. Chief limitations to widespread distribution of seed are: (1) the shortage of ONDR workers, especially in Sahel, (2) the inadequate transportation system throughout the country, and (3) the source of funds to operate the entire seed program. A portion of the Institutional Development Project now in preparation is concerned with increasing the number, as well as the effectiveness, of the ONDR field agents. An AID road repair project and a road building project under consideration should alleviate some transportation difficulties. This leaves financing for consideration and action. At the present time, no decision has yet been made on this important point.

There are three principal areas of operation where funds, or some other types of purchasing power, are required, namely (1) to pay the Seed Multiplication Units for seed produced; (2) to pay farmers who contract to produce seed for the Seed Multiplication Units, and (3) to pay ONDR for the seed distributed to farmer users. The success of the entire seed program depends largely upon how satisfactory these obligations can be met. A seed multiplication project must have working capital. Funds are required for expenditures on labor, fuel and other production inputs. Cash, or an acceptable substitute, must be available to pay contract seed growers when they deliver the harvested seed to the Multiplication Units. These Units, therefore, will have funds tied up in seed inventory for six months or more before the seed can be sold.

In the first year or so of the project, operation funds provided within the project should cover major production and handling costs, particularly on the Dougui Unit where the FAO project also contributes some operational funds. This is not a permanent solution, however, and does not provide funds with which the Multiplication Units can pay contract

growers. Ideally, each Multiplication Unit should have a revolving fund from which to pay expenses of production and purchases, which would be replenished when seed is sold to ONDR. On the matter of how the farmer will pay for the seed distributed by ONDR, payment at time of purchase is practically impossible. He is without funds and cannot spare grain to sell. Under these conditions he is inclined to plant whatever grain he has on hand, even if he thinks the seed from ONDR might be better.

This shortage of money in all of the critical areas in the seed project indicates that some sort of trading system needs to be devised. Perhaps a revolving fund for the Seed Multiplication Units could be established through sale of grain by the Grain Purchasing and Distribution Program or from PL 480 grain. On the matter of the farmer paying, ONDR could give him the seed at planting time and receive payment in grain at harvest time. The amount of grain which the farmer would return, theoretically should equal the cost of production and distribution. In practice, the amount returned would be in relation to its value under the prevailing circumstances at the time. If the farmer can be induced to use improved cultural practices at the same time he tries improved seed, his yields should be increased enough that he would be well satisfied with the contribution of the good seed. The amount of grain returned probably should range between 1 1/4 to 2 times the amount of seed received. The grain thus received by ONDR could be sold and funds returned to the Multiplication Units. The financing system described would be somewhat cumbersome but has the advantage of allowing the farmer to purchase seed on credit at a reasonable rate of exchange in grain.

The Promotional Program

Aside from its function as seed distributing agent, ONDR has the responsibility for promoting the use of improved seed among farmers. The multiplication and distribution

systems are of little use unless the farmer purchases and uses the seed. An effective extension program will play an important role in creating a demand for improved seed. ONDR should organize promotion campaigns, citing the value of the improved seed based upon research data and with the help of the research stations, plant demonstration plots near villages so that farmers will be able to observe the performance of the new seed. In connection with the distribution program ONDR should encourage the use of general production recommendations of the research stations. These and any other appropriate extension methods should be used to convince farmers to try the new seed.

The Training Program

Undergirding the seed project will be a strong training program conducted in-country, with technical personnel, seed growers, and farmer advisors as primary target groups. Responsibility for the training will rest primarily on a few key personnel who will be trained in seed technology outside Chad. These key personnel will be the officers of the Division of Seeds and the Seed Multiplication Units.

Training will be at several levels:

1. Degree training in agronomy - seed technology to the M.S. or B. S. degree level, depending upon the academic background of the trainees. This training will be accompanied by as much practical field and laboratory work as the academic schedule permits. The training will cover all areas of seed program development and implementation-production, processing, testing, storage, organization, and administration. Training at a university such as Mississippi State is recommended. Those persons to be designated as Director and Associate Director of the Division of Seeds will be chosen as candidates. Training will be initiated as early in the project as possible. Twenty-four months plus time to gain English language proficiency must be allowed for the training.

2. Practical training in a third country. This training will be concentrated on the production techniques required for producing varietally-pure seed of high quality under less-than-desirable working conditions. A successful ongoing seed program in another African country would be desirable, but since most African seed programs are in their infancy, at least the first one or two trainees will be send to IITA. Four trainees are scheduled to be sent for training, one each in years 2, 3, 4. and 5. Three selected for training are to be assigned to the Multiplication Units and one to the Division of Seeds.

3. In-country training on the various aspects of seed production, promotion, and marketing. Training will be addressed to several key groups involved in the program. Once established and staffed,the Division of Seeds will be responsible for the entire training program, but will be assisted by personnel from the research stations, Seed Multiplication Units and ONDR. Outside consultants can be used to organize at least one intensive short course after the two participants return from study in the U.S. Consultants for assisting with this type of training can be obtained through the AID/TAB contract with Mississippi State University.

4. In-service training will be provided for all new personnel. Those requiring this type of training are in the following groups:

(a) Officers in charge of the Seed Multiplication Units who have had third country training will be provided on-the-job training in the installation and operation of seed processing equipment. The officers of the Dougui and Deli Units can receive this training from U.S. consultants during the installation of the equipment at Dougui. These two officers, together with the officer from Biliam Oursi can both teach and learn

while installing the equipment at Deli and Biliam Oursi without outside assistance.

(b) Contract seed growers will be given instruction in selecting fields, preparation of land, isolating seed crops from others, rouging off-type plants, harvesting, and use of other agricultural inputs to maximize yields and quality of seed produced.

(c) Field inspectors will be taught how to inspect seed multiplication fields in order to maintain varietal purity, how to help the farmer in his early efforts to produce improved seeds, and how to take seed samples for laboratory analysis.

(d) Seed analysts will be trained in the use of proper methods for testing seed in order to ensure accurate description of seed lots in reference to purity and viability.

(e) ONDR personnel will be advised about the characteristic of the several varieties of improved seed in order to properly advise the farmers. Also, the extension people will receive instructions on how to plant comparative demonstration plots and how to use these plots and other promotional methods to create a desire among farmers for the improved seeds.

Training of personnel working within the seed multiplication program will be a necessary and continuing activity. As new varieties are released and improved and practical cultural practices are developed there will be a great need for trainers. Availability of trainable personnel, the type of training and the application of the training to the solution of problems will determine to a great extent the success of the program.

Limitations of the Project

The use of the improved seed alone cannot be expected to increase food supplies to the extent of making up present deficiencies and keeping abreast of population growth. Admittedly, the widespread use of improved seed can be expected to narrow the gap between production and needs, but the race will not be won by production unless supported by a strong agricultural research base, an effective extension service, a workable marketing system, a sound institutional framework, the right kind and amount of technical assistance, and trained and motivated public and private citizenry. The Agricultural Research and Grain Marketing project of which seed multiplication is a part and the proposed Agricultural Institutional Development project, are expected to provide the major types of assistance required.

Effect on Employment

This project is not expected to have any marked effect upon employment. Since it is addressed to supplying food needs of the subsistence farmers, it is unlikely that increased farm production due to the project will have any effect in shifting employment patterns.

The technology to be used in this project is not expected to drastically alter farming patterns or eating habit trends that are not already current. Sorghum and millet will still be the principal food crops, although there will be a slight shifting to rice and wheat as living standards increase. New varieties released will have been tested for public acceptance as well as for agronomic characteristics.

Government Support

There is some doubt that the host government can provide the manpower and other resources necessary to support a successful program. But since the seed project has a high

priority with the government, it must be assumed that it will be supported. If the Government creates a Division of Seeds, with staff positions funded and provides personnel for training on schedule, these actions will indicate an initial commitment to the project.

Environmental Impact

The project envisions the construction of four buildings, consisting of three combination seed processing-seed storage buildings and one office-seed testing building. They will be constructed on sites designated by the Ministry of Agriculture. In all cases the land will be under the administration of the Ministry and proper measures will be taken to ensure that buildings are so located as to maximize use of existing roads, that sewage disposal systems are properly designed and that construction activities do not have any adverse impact on soil erosion or water supplies.

It is anticipated that the proposed seed multiplication program will have a beneficial impact on the environment by helping promote improved agricultural practices, such as, the use of rotations, weed control and soil conservation practices.

The project can also be expected to have a favorable impact of a sociocultural nature, as it will play an important role in increasing domestic food production in a country suffering widespread hunger.

ECONOMIC ANALYSIS

The seed multiplication project can make a rather sizable impact on the lives of many Chadian peasant farmers and their families.

There is no way of knowing how readily seed developed and multiplied under this project will be accepted, nor how widespread the practice of planting the seed will occur. It depends upon the quality of the seed, the superiority of the crops produced from the seed and whether the grain produced from the improved seed is as palatable as

that to which the farmer and his family are accustomed. Too, the readiness with which seeds are accepted depends upon the price in relation to the value, and upon the availability of the seed at the time when needed. Multiplication of seed per se is less likely to be a limiting factor than these others in influencing acceptance of and demand for improved seed.

Based on seed requirements in 1982, production rate of 1,000 tons per year in itself will produce enough seed to supply 4 percent of the estimated annual seed needs.

The actual value of the improved seed, however, will be greater than just 4 percent per year, due to the fact that many farmers represented in the 4 percent probably will replant his "seed" from his own production rather than acquire new seed. Additionally, others will obtain some of the same "seed" to plant. Still, other farmers will plant from the the second generation increase from the Multiplication Units. On the basis of modest assumptions that (1) some farmers will be planting seed produced by the project while others will be planting grain from this and subsequent generations, and that (2) each generation beyond the seed produced by the project will produce 5 percent less each year, it is possible that in any particular year the seed planting pattern could approach or exceed the situation where:

> 4 percent of the country's production is planted with seed produced in the Multiplication Units (M_3) which yields 20 percent above average grain yields.
>
> 10 percent of the production is planted with grain produced from the M_3 generation of seed which yields 15 percent above average.
>
> 20 percent of the production is planted with grain produced from the second increase from M_3 which yields 10 percent above average.

In such a situation, 34 percent of the agricultural food production area will be planted with improved seed or the progeny of such seed and will produce a net increase in total production of almost 15 percent.

In the event that the project reaches the goal of producing and distributing 1,000 metric tons of seed by 1982, the benefits will be even greater than suggested above. For instance, during the third and fourth years of the project, 500 tons of seed will have been produced in addition to that produced in the fifth year. The 1,500 tons of seed thus provided during the project period are sufficient to produce over 70,000 metric tons of grain of sorghum, millet, rice, peanuts and corn. Although this is the projected end of project status, the production from the 500 tons produced during the first four years is not considered in the yearly production assumption in the previous illustration.

After year 5 the spread effects are expected to increase even more as superior varieties gradually replace others. By this time, or sooner, other development projects are expected to initiate seed multiplication programs, primarily in wheat. If project purpose is achieved, or approached, by year 5, the multiplying effects will be quite significant.

It is practically impossible to translate economic benefits into financial terms on a project such as this in a country such as Chad. It is not so much a matter of contributing to the financial status of the recipients, as it is of helping alleviate the misery of people who often do not have access to sufficient food. The economic benefits are produced in the form of increased food production. As the majority of farm families are at the subsistence level of living, there will be an immediate economic benefit derived from increased yields and production.

BUDGETARY ANALYSIS

Only about five percent of the budget will be applied to personnel services. By locating the first two seed multiplication units on research stations, the project will have the services of FAO personnel on one station and USAID agronomists (on the research

sub-project) on the other to supply guidance on a continuing basis. Concentrating early project activities at these locations will not only provide close supervision but will save funds on the technical assistance component. Ten months of short-term consultancy will supplement technical assistance of these on-station personnel.

Training in the U.S. will be kept to an absolute minimum. Only the two project leaders will be provided academic training while four other leaders will be trained in a third country in Africa. All other training will be done in Chad through short courses and in-service training. U.S. inputs to training represent only six percent of the budget.

Almost three-fourths of project resources will be used to supply buildings and equipment. None of the project locations have any buildings which can be spared for the seed multiplication project. Because of the extremely limited resources of the Chadian Government, funding must be supplied under the project. Buildings will be constructed locally of masonary materials. Specialized equipment for processing, quality control and storing seed will be supplied to each of the three Seed Multiplication Units. Seed testing equipment will be provided for the National Seed Testing Laboratory. Vehicles will be furnished for locations and purposes as follows: One 10-ton truck and one motorbike will be furnished each of the Seed Multiplication Units (No truck will be supplied to the Dougui station since FAO has already supplied one). A Land-Rover type vehicle and six motorbikes will be provided for the Division of Seeds, the motorbikes to be used by field inspectors.

Again, due to the poor monetary situation in the country, funds representing 16 percent of the total will be allocated for operations and supplies.

The chief budgetary contribution of the Chadian Government will be in providing salaries for personnel working in the project. These include: the Director, Associate

Director and one assistant in the Division of Seeds, one manager and one quality control person for each Seed Multiplication Unit, and three seed analysts in the National Seed Testing Laboratory. This will entail considerable effort on the part of the government, but is considered essential for a successful seed multiplication program to become established and grow. It is assumed that ONDR has sufficient personnel already employed to administer and implement the promotion and distribution portions of the project.

IMPLEMENTATION PLAN

The two persons who will head the Division of Seeds should be selected as soon as possible so that they may be sent for language study and subsequent training soon after the project agreement is signed. Also, construction of the seed processing and storage buildings at Dougui should proceed with haste in order to be used for the next harvest. To save time, preliminary plans for the buildings should be prepared prior to the approval of the project in order for construction to begin immediately upon signing of the project agreement. Request of AID/W to supply this service through the AID/TAB- Mississippi State University Contract as quickly as possible will expedite the preparation of plans on time.

1978

January 1	Request building lay-out plan, equipment list and specifications for Dougui location from Mississippi State University via AID/TAB.
February 1	Project Paper approved.
March 1	Project Agreement signed.
March 1	Director and Associate Director of Division of Seeds named.
March 1	Building plans and equipment specifications for Dougui received from Mississippi State University.
March 5	PIO/C issued for equipment purchase from U. S.

March 15	Officer in charge of Seed Multiplication Unit in Dougui announced and put on the job for in-service training and subsequent employment.
April 1	Invitation to bid issued for construction of seed processing and storage buildings at Dougui.
May 1	Construction of buildings begins at Dougui and fabrication in N'DJamena of the hopper-bins for the Dougui installation.
May 15	Officer to be in charge of Deli Seed Multiplication Unit designated and assigned to Dougui for in-service training.
August 15	Two participants in language training center U.S. University.
September 30	Construction of buildings at Dougui and hopper-bins completed.
October 1	Equipment arrives from U.S. and transported to Dougui.
October 1	Request to AID/W of Mississippi State to provide consultants to help set up equipment.
November 1	Mississippi State consultants arrive to set up equipment at Dougui and train operators, including those to be responsible in Deli.
December 1	Seed processing operations begin at Dougui on pre-project produced seed.
December 5	Progress of project evaluated.

1979

January 1	PIO/C issued for purchase of equipment in U.S. for Deli.
January 15	PIO/P issued for officer in charge of Deli Seed Multiplication Unit for training in IITA.
January 15	Invitation to bid issued for construction of seed processing and storage buildings at Deli.
February 15	Construction begins on buildings at Deli and fabrication in N'DJamena or Moundou of the hopper-bins for the Deli installation.
February 15	Participant leaves for third country training.
May	Seed is planted in Dougui.
May	Seed is planted in Deli.
July 1	Construction of buildings at Deli and fabrication of hopper-bins completed.

August 1	Equipment arrives from U. S. and delivered to Deli.
August 15	Officer in charge at Deli returns from third-country training.
September 1	Officer to be in charge of Biliam Oursi designated and assigned to Deli for in-service training during equipment installation.
September	Equipment installed at Deli under supervision of the officer in charge of Deli Seed Multiplication Unit, assisted by personnel from Dougui Multiplication Unit.
October 1	PIO/T issued for consultant services to check out the installation at Deli.
November	Seed processing operations begin in Dougui.
December	Seed processing operations begin in Deli on foundation seed.

1980

January	PIO/C issued for purchase of equipment in U.S. for Seed Multiplication Unit in Biliam Oursi and seed testing laboratory in N'D Jamena.
January 15	PIO/P issued for officer in charge of Biliam Oursi Seed Multiplication Unit and for officer to work in Division of Seeds Office for third-country training.
February 15	Construction begins on buildings at Biliam Oursi and fabrication of hopper-bins and construction of seed testing laboratory building in N'D Jamena.
February 15	Participants leave for third-country training.
April	Seed distributed from Dougui and Deli Seed Multiplication Units by ONDR.
May	Seed planted at Dougui and Deli.
July 1	Construction of buildings at Biliam Oursi and N'D Jamena. fabrication of hopper-bins completed.
August 1	Equipment arrives from U.S. and delivered to sites.
August 15	Participants return from third-country training.
August 30	Participants return from training in U.S.

September 1	PIO/T issued for consultant services to conduct training course in November.
September	Equipment installed at Biliam Oursi under supervision of officer in charge of Multiplication Unit assisted by personnel from the Multiplication Unit in Deli.
September	Division of Seeds staff train field inspectors by short course and in-service training.
October	Seed harvested at Dougui and Deli.
Oct., Nov., Dec.	Seed dried, processed and placed in storage.
November	Consultants arrive to conduct short course for all technicians working in seed project; particularly those in seed processing and seed testing.

1981

April	ONDR receives seed from Multiplication Units and begins distribution to farmers.
April	Division of Seeds conducts course for ONDR personnel.
April	Foundation Seed Units receive seed from research station; Multiplication Units receive stocks from Foundation Seed Units.
April	Contract seed growers receive training in seed production methods.
May	Seed planted.
July-Sept.	Seed-Multiplication fields inspected.
October	Seed harvested at all locations.
Oct., Nov., Dec.	Seed dried, processed and placed in storage.
November	Progress of project evaluated.

1982

April	ONDR receives seed from Multiplication Units and begins distribution to farmers.

April	Foundation Seed Unit receive breeders (M_o) seed from the research stations; Multiplication Units receive foundation stocks from the Foundation Seed Units.
May	Seed planted at all locations.
June	Division of Seeds conducts series of training activities for all technical personnel and seed growers.
July-Sept.	Seed multiplication-fields inspected.
October	Seed harvested at all locations.
Oct., Nov., Dec.	Seed dried, processed and placed in storage.

LOGICAL FRAMEWORK MATRIX

Project Purpose	End-of-Project Status	Means of Verification	Assumptions
B. Seed Multiplication To increase small farmer productivity by providing adequate quantities of improved seed at reasonable prices.	B. Seed Multiplication 1. Area planted by small farmers with improved seeds during the project period will have increased from 0 to 90,000 hectares which produce 70,000 metric tons of grain. 2. Average yield of sorghum, millet, peanuts, rice and corn planted from project-improved seed will have increased by 20%. 3. Seed costs to the farmer will be no greater than non-project-improved seed per unit of grain produced.	B. Seed Multiplication 1. ONDR distribution records. 2. Comparison of grain yields of farmers using project-improved seeds with those not using improved seeds. 3. ONDR sales records and sampling of field yields.	B. Seed Multiplication 1. The Government of Chad has made or will make a committment to support an expanded seed multiplication program. 2. The Ministry of Agriculture will establish a Division of Seeds whose sole purpose will be to expedite production and marketing of improved seeds. 3. A strong research program is established and developed to supply genetic stocks of superior varieties. 4. The ONDR (extension) will assume major responsibility for seed distribution and promotion activities. 5. Satisfactory arrangements can be made for financing the multiplication of seed, particularly that produced by contract growers. 6. The farmers accept the improved seed and are willing to purchase and plant such seed when available. 7. Other agricultural inputs will be available in order to maximize use of improved seed. 8. Adequate personnel for manning the project will be available for training.

Project Outputs

B. Seed Multiplication

1. Foundation seed units established and operable, including seed processing and storage facilities.

2. Seed Multiplication Units established and fully operable in:

   a. Seed Production

      (1) on farms of the Units

      (2) with contract growers

   b. Processing (drying, cleaning, testing and treating)

   c. Storage

3. Seed produced by the Multiplication Units distributed by ONDR to Chadian farmers.

Magnitude of Outputs

B. Seed Multiplication

1. One unit each at Dougui and Deli.

2. One unit each at Dougui, Deli and Biliam Oursi. Production of improved seed will be a follows:

		Sorghum/Millet	Peanuts	Rice	Corn
a. Dougui:	Year 3	50	50		
	Year 4	100	100		
	Year 5	100	250		
b. Deli:	Year 3	10		15	
	Year 4	25		50	
	Year 5	150	25	100	50
c. Biliam-Oursi:	Year 4	50		50	
	Year 5	50	25	200	50

3.

	Number of Farmers	Number of Hectares
Year 3	3,480	8,700
Year 4	10,400	26,000
Year 5	22,400	56,000
Total	36,200	90,700

Means of Verification

B. Seed Multiplication

1. Records of Foundation Seed Units.

2. Production records of Seed Multiplication Units.

3. Seed distribution records of ONDR.

Assumptions

B. Seed Multiplication

1. Construction of buildings, delivery and installation of equipment will be on schedule.

2. Personnel trained and experienced in seed production, processing, testing, and distribution techniques will become available at a rate equal to the projected growth of the project.

3. ONDR will conduct an effective promotion and seed distribution program.

Project Outputs	Magnitude of Outputs	Means of Verification	Assumptions
B. Seed Multiplication	B. Seed Multiplication	B. Seed Multiplication	
4. Technicians trained in seed production and other essential areas of seed technology in the U.S., third country and local.	4.	4. PIO/Ps and technicians working in positions for which they were trained.	

	U.S.	3rd Country	Local
Year 1			10
Year 2	2	1	20
Year 3		1	40
Year 4		1	50
Year 5		1	80
	Agronomy-Seed Technology	Seed Production	Seed production, processing, inspection, testing, distribution

5. National Seed Testing Laboratory established.	5. One laboratory established under Division of Seeds of the Ministry of Agriculture in N'DJamena by end of third year of project. Approximate number of seed samples tested should be as follows:	5. Records of Seed Testing Laboratory.	

Year 4	1000 (Number of Samples)
Year 5	2000 (Number of Samples)

U. S. Inputs	Quality of Inputs					Means of Verification	Assumptions
B. Seed Multiplication	B. Seed Multiplication					B. Seed Multiplication	B. Seed Multiplication
	Implementation Target						
	FY78	FY79	FY80	FY81	FY82		
1. Personnel services	(2 PM)	(2 PM)	(2 PM)	(2 PM)	(2 PM)	1. USAID/Chad PIO/Ts	1. The services of short-term consultants can be obtained when needed.
Short-term consultants	20	20	20	20	20		
2. Training	(24 PM)	(24 PM)				2. USAID/C PIO/Ps and GOC records of participant training program.	2. The candidates for training are available and are retained for work in area of expertise after training.
U.S. participants	25	25					
Third Country		(12 PM) 8	(12 PM) 8	(12 PM) 8	(12 PM) 8		
Local	(20 PM) 4	(20 PM) 4	(20 PM) 4	(20 PM) 4	(20 PM) 4		3. The costs of equipment and buildings remain within estimates.
3. Commodities						3. USAID/C PIO/Cs and records of receipt of equipment and assignment to foundation seed and multiplication units.	4. The GOC will have adequate funding for salaries and active programs.
Vehicles							
Truck, 10-ton, 2 units		45	45				
Land Rover type, 1 unit			15				
Motorbike, Mobilette type			5				
Seed Processing and Storage Equipment	155	160	160				
Seed Testing and Quality Control Equipment			20				
4. Other Costs	250	300	300			4. Multiplication Units records of operating expenses.	
Building construction							
Seed Multiplication Units, 3 units	250	300	300				
Seed Testing and Quality Control Laboratory			120				
Operations and supplies	40	80	140	140	140		
Project Evaluation	20			20			
Sub-Total	514	642	837	192	172		

APPENDICES

APPENDIX 1.

PRINCIPLE DRYLAND CROPS IN 1975 (CHAD)

ZONE	FOOD CROPS					
	Millet & Sorghum		Rice		Peanuts	
	Hectares (000)	Metric Tons (000)	Hectares (000)	Metric Tons (000)	Hectares (000)	Metric Tons (000)
South	670	363	15	12	170	73
North	515	277	4	5	20	9
Total	1185	640	19	17	190	82

From: Club Des Amis du Sahel, Rapport de Synthese - Situation de l'Agriculture en 1975-76.

APPENDIX 2.

NEEDS AND ANTICIPATED FOOR GRAIN DEFICITS BASED UPON THE NATURAL RATE OF PRODUCTION (METRIC TONS)*

CROP	YEAR			
	1975	1981	1982 (Interpolated)	1990
Millet and Sorghum				
Needs		761,000	785,000	981,000
Natural production	613,000	674,000	685,000	778,000
Deficit		87,000	100,000	203,000
Rice (paddy)				
Needs		54,000	60,000	108,000
Natural production	42,000	46,000	47,000	53,000
Deficit		8,000	13,000	55,000
Peanuts				
Needs		112,000	117,000	156,000
Natural production	95,000	104,000	106,000	120,000
Deficit		8,000	11,000	36,000
Corn				
Needs		31,000	33,000	51,000
Natural production		25,700	26,000	29,500
Deficit		5,300	7,000	21,500
Wheat				
Needs		16,000	17,000	23,000
Natural production	3,000	3,200	3,300	3,700
Deficit		12,800	13,700	19,300
Sesame				
Needs		16,000	17,000	22,800
Natural production	12,500	14,000	14,200	16,000
Deficit		2,000	2,800	6,800

*Assuming the natural rate of production equals the increase in rural population.

From: Report of the Agricultural Sub-Committee, Ministry of Agriculture Planning Office, October, 1977.

APPENDIX 3.

EQUIPMENT FOR THE SEED MULTIPLICATION UNIT AT DOUGUT
(FOR YEAR 1)

Item No.	Item	No. Required	Cost ($US)
1	Elevator - Re: Universal Model B2-75	1	1,000
2	Surge Bin - Local construction	1	1,000
3	Air Screen Cleaner - Re: C rippen Model NW334	1	11,000
4	Elevator - Re: Universal Model B2-75	1	1,200
5	Surge Bin - Local construction	1	1,000
6	Gravity Separator - Re: Oliver Model 80	1	3,500
7	Vibrator Conveyor - Re: No. 7, AT Ferrell Cleaner	1	800
8	Elevator - Re: Universal Model B2-75	1	1,100
9	Surge Bin - Local construction	1	1,000
10	Seed Treater - Re: Gustafson: Model B	1	2,000
11	Elevator - Re: Universal B2-75	1	900
12	Surge Bin - Local construction	1	1,000
13	Bagging Scale - Re: Howe Richardson model G-17	1	2,000
14	Additional Equipment and Supplies Examples: Bag closer, platform scales, bag trucks, bag conveyor, vacuum cleaner, air conditioners, dehumidifier, and other small items		11,000
15	Seed testing and quality control equipment Examples: Seed divider, scales, moisture tester, germinators, hygro-thermographs, refrigerator, triers, and other small items and supplies		5,700

Item No.	Item	No. Required	Cost ($US)
16	Shop equipment and supplies Examples: Jacks, vices, air-compressor, welder, welding rods, drills, grinder, hoist, wrenches and other hand tools		5,000
17	Electrical equipment and supplies Examples: Switches, relays, conduit, thamps and all else required to install equipment operation		3,000
18	Generator w/engine - Re: Onan Model 45 kw	2	20,000
19	Thresher	1	13,000
20	Peanut cleaner - Re: Hobbs Model 403	1	6,500
	Total for equipment, FOB supplier		91,700
	Collecting for shipment (7%)		6,419
	Crating and shipping (60%)		55,020
	Total for equipment delivered in N'D Jamena		153,139

The expected life of each equipment item is estimated at 15 years.

Note: Upon request a detailed listing, description of each item suggested, suppliers and plans indicating the position of all fixed equipment within the building can be supplied through an existing AID/TAB contract with Mississippi State University.

Items 1 through 13 will be cross-referenced to both description of items and layout plans. Construction plans will be provided for items 2, 5, 9, and 12.

VEHICLES
(FOR YEAR 3)

Item	No. required	Cost ($US)
Motorbikes - Re: Mobilettes	1	500

The price estimate on the vehicles includes delivery to N'D Jamena.

APPENDIX 4.

EQUIPMENT FOR THE SEED MULTIPLICATION UNIT AT DELI (FOR YEAR 2)

The equipment is the same as for the Dougui Unit plus the corn sheller listed below:

Item No.	Item	No. Required	Cost ($US)
13A	Corn sheller w/conveyor - Re: Western	1	5,000
	Other equipment (same as Dougui)		91,700
	Total for equipment, FOB supplier		96,700
	Collecting for shipment (7%)		6,769
	Crating and shipping (60%)		58,020
	Total for equipment delivered in N'D Jamena		161,489

VEHICLES (FOR YEAR 3)

Item	No. Required	Cost ($US)
Truck	1	45,000
Motorbike - Re: Mobilette	1	500
Total Vehicles		45,500

The price estimates on the vehicles include delivery in N'D Jamena.

APPENDIX 5.

EQUIPMENT FOR THE SEED MULTIPLICATION UNIT AT BILIAM OURSI (FOR YEAR 3)

The equipment required is the same as for the Dougui Unit plus the corn sheller listed below:

Item No.	Item	No. Required	Cost ($US)
13A	Corn sheller w/conveyor - Re: Western	1	5,000
	Other equipment (Same as Dougui)		91,700
	Total for equipment, FOB supplier		96,700
	Collecting for shipment (7%)		6,769
	Crating and shipping (60%)		58,020
	Total for equipment delivered in N'D Jamena		161,489

VEHICLES (FOR YEAR 3)

	No. Required	Cost ($US)
Truck, 10 Ton	1	45,000
Motorbike - Re: Mobilette	1	500
Total vehicles		45,500

The priceson the vehicles include delivery in N'D Jamena.

APPENDIX 6.

EQUIPMENT FOR THE NATIONAL SEED TESTING LABORATORY IN N'D JAMENA

Item No.	Item	Request	Cost ($US)
15-1	Seed Divider	1	240
15-2	Gram Scales	2	200
15-3	Official Test Weight Apparatus	1	600
15-4	Moisture Tester	1	750
15-5	Dazor lamp, desk type	3	330
15-6	Purity workboards w/Diaphanascope	3	100
15-7	Torsion Balance, DLM 2-1	2	700
15-8	Magnifier and Stand	3	100
15-9	Forceps, 5 1/2" long, serrated	12	50
15-10	Forceps, 5" long, smooth	12	50
15-11	Sample (grain) pan, triangular	6	45
15-12	Sample (grain) pan, spout type	6	45
15-13	Sample (grain) pan, round	6	8
15-14	Bag Trier, 39" x 7/8"	2	80
15-15	Bag Trier, 30" x 1/2"	2	70
15-16	Germination	3	1650
15-17	Hygrothermograph	1	375
15-18	Sling Psychrometer	2	70
15-19	Refrigerator	1	330
15-20	Crisper, plastic w/cover	50	85

Item No.	Item	No. Required	Cost ($US)
15-21	Petri Dishes, plastic	100	30
15-22	Spear Grain Envelopes, 8 oz.	1000	55
15-23	Spear Grain Envelopes, 12 oz.	1000	80
15-24	Germination towels	5 reams	155
15-25	Filter paper	10 pkts.	25
15-26	Germination blotters	5 reams	550
15-27	Stencil Set for marking bags	1	55
15-28	Grain Sample Bottle, quart size	25	30
15-29	Grain Sample Bottle, pint size	50	55
15-30	Moisture Tester	1	800
15-31	Oven	1	550
15-32	South Dakota Blower	1	900
15-33	Binocular Microscope	1	600
	Total for equipment, FOB supplier		9763
	Collecting for shipment (7%)		683
	Crating and shipping (60%)		5858
	Total for equipment delivered in N'D Jamena		16,304

Note: A detailed description of each item and suggested suppliers can be supplied upon request through an existing AID/TAB contract with Mississippi State University.

Items common to the quality control laboratories in the Seed Multiplication Units carry the same item number.

APPENDIX 7.

VEHICLES FOR THE DIVISION OF SEEDS
(FOR YEAR 3)

Item	No. Required	Cost ($US)
Land-Rover type	1	15,000
Motorbike - Re: Mobilette (for inspectors)	6	3,000
Total vehicles		18,000

The price estimates on vehicles include delivery in N'D Jamena.

APPENDIX 8.

GENERAL DESCRIPTION OF THE BUILDING CONSTRUCTION

Each Seed Multiplication Unit at Dougui, Deli and Biliam Oursi will be composed of three building components which can be the same structure or adjacent ones. The components are (1) seed processing plant, (2) seed storage warehouse, and (3) seed testing (quality control) laboratory, including offices.

The seed testing laboratory component contains three offices, a seed testing equipment room, a storage room, and a rest room. It is a single floor structure with sidewalls 3.0 meters high. The building has no special construction requirements. Ordinary office-type masonry construction is satisfactory. Floor area is about 120 m^2.

The seed processing plant occupies about 200 m^2 of space. Side wall height is 7 meters and ridge line 10 meters. The walls have conventional masonry construction. All equipment will be supported from the concrete floor, but will require bracing from the superstructure. The concrete floor should have a compressive strength of 2,750 pounds per square inch (after 27 days) and be reinforced with No. 6, 6 inch x 6 inch reinforcement wire.

The flat storage warehouse occupies about 260 m^2 of floor space. Wall height is 5 meters. It can be constructed of locally-available materials commonly used in conventional warehouses. The concrete floor should meet the same standards as the processing plant. A vapor-barrier should be placed between the soil and the concrete. Special attention is required to assure that drainage away from the building is adequate. Precautions should be taken to prevent entrance of rodents and birds.

The National Seed Testing Laboratory building, which also will have offices for staff of the Division of Seeds, occupies about 300 m^2 of floor space. Wall height is

3.0 meters. Construction may be of locally-available materials of conventional architectural design.

It is recommended that windows in the analysis area of the testing laboratory face in a northerly direction.