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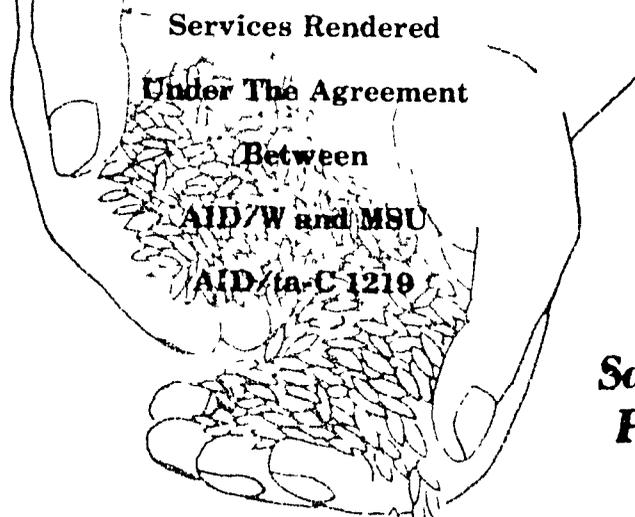
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AGRONOMIC RESEARCH SUB-PROJECT
OF THE
AGRONOMIC RESEARCH, SEED MULTIPLICATION
AND
GRAIN/MARKETING PRP FOR CHAD



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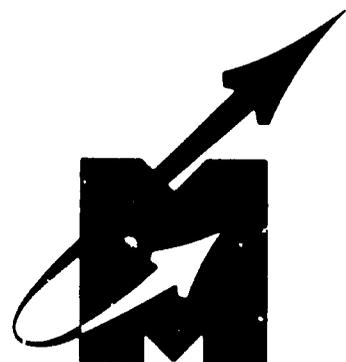


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REPORT SUMMARY

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

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

CONSULTANT : Howard C. Potts-Agronomic Research

TDY PERIOD: 4 October - 29 October, 1976

SUMMARY

1. Services were requested under AID/ta-C-1219 to provide one consultant on seed multiplication to follow-up a previous consultation (Report No. Ta 76-11) and a second consultant in agronomic research. Specifically the two MSU consultants and a grain marketing consultant, supplied by the TAB/KSU contract, were requested to prepare the technical aspects of a Project Review Paper entitled, "Agronomic Research, Seed Multiplication and Grain Marketing Project."
2. The PRP was prepared following consultations and field visits with and in the company of key Chadian and USAID/C personnel. The PRP, which constitutes the recommendation of the PRP team, was reviewed in detail by USAID/C personnel and the program officer requested the research consultant to prepare the information included on pages 1 to 25 of this report in a manner which would permit its use as ANNEX B to the PRP. Pages 12-23 of MSU Report NO. 76-11, "Seed Multiplication and Distribution in Chad" are to be attached to the PRP as ANNEX C. ANNEX D to the PRP is to be submitted by the grain marketing consultant.
3. This report primarily encompasses the general commentary on the current situation and program of the Department of Agronomic Studies, MA-GOC; a description of the proposed technical assistance support to strengthen Chad's agronomic research capability, and an illustration of some of the key technical and programmatic factors outlined in the body of the PRP.

ACKNOWLEDGEMENTS

The author wishes to express his appreciation to his team members, Dr. Roe Borsdorg and Dr. Charles Vaughan and to Heitz Gratz for their patience, support and particularly their jocularly without which this assignment would not have been completed.

To Dr. Bob McAlister and Art Theison my profound respect for your vision in which I can not share at this time. Sincere thanks are extended to Mack Prosser and Dick Delaney USAID/C for their willingness to make positive contributions to the PRP. Dick, "service" as a noun means (a) useful labor that does not produce a tangible commodity (b) contribution to the welfare of others (c) the work or action performed by one who serves.

Grateful appreciation is extended to Mr. Langarsou, Mr. Siniki, Mr. Kabadi and Mr. Brahim of the GOC for their willingness to share their ideas and knowledge.

Howard C. Potts

Mississippi State University

November 16, 1976

List of Terms Used in this Report

- ARSMGM - Agronomic Research, Seed Multiplication and Grain Marketing Project
- Bol polders - Land areas located on the east edge of Lake Chad near the city of Bol protected by levees to prevent inundation during the fall floods.
- DA - Direction of Agriculture
- DAS - Division of Agronomic Studies
- FAC - French equivalent to USAID
- FDAR - Fund for Development and Rural Action (Grain Marketing and Storage)
Semi-autonomous
- FED - European Common Market equivalent to USAID
- IRD - Intergrated Rural Development Project (PRP in preparation)
- IRCT - Research Institute for Cotton and Textiles (French organization for cotton research not connected to MA).
- MA - Ministry of Agriculture and Pasture Development and Efforts against Natural Calamities.
- ORSTOM - French Tropical Soils and Hydrology Research Organization

Agronomic Research Component
of the
Chad Agronomic Research, Seed Multiplication
and Grain Marketing Project

I. INTRODUCTION

The need for accelerating improvement in several areas of the agricultural sector of the Chadian economy were identified and reported in the Development Assistance Paper (DAP) for Chad prepared during 1975. Among the key institutional programs in agriculture identified as in need of support were: the Department of Agronomic Studies-MA, which has responsibility for both agronomic research and seed multiplication, and, "Fonds du Developpement et de Action Rurale" (FDAR) which is responsible for the public sector grain marketing and distribution activities.

Project Identification Documents (PID's) were prepared in cooperation with MA officials for each of these three major programs during June 1974. One result of the AID/W review of the PID's submitted was the combining of the three PID's into a single project, "Crop Production and Marketing Research" (CPMR). Because of the title CPMR did not accurately convey the project's activities the name was changed to the, "Agronomic Research, Seed Multiplication and Grain Marketing Project" (ARSMGM).

The team selected to prepare the Project Review Paper (PRP) was composed of a research agronomist, a seed technologist and a grain marketing economist. The services of these consultants were provided through TAB contracts with the Mississippi State and Kansas State Universities. After a short briefing in Washington the team arrived in Chad on October 6 and departed October 28.

The primary purpose of this report is to update the documented information and describe in greater detail than possible in the PRP the technical aspects of Chad's existing agronomic research program and means of overcoming the major impediments to the information flow between research and extension workers. Pages 1 through 25 of this report are intended to be used as Annex B to the ARSMGM-PRP.

II. CURRENT SITUATION

1. Organization

Responsibility for conducting research on soils and agronomic crops, other than cotton, is assigned to the Division of Agronomic Studies (DAS). This Division is one of three divisions under the Directorate of Agriculture of the Ministry of Agriculture. An organizational and staffing chart is given as Figure 1. The DAS is also responsible for making the initial multiplication of seeds of superior varieties of the food crops whether selected locally or introduced. The food crops of major importance to Chad are sorghum, millet, maize, peanuts, rice, wheat and cowpeas.

The national headquarters for the DAS is located in N'Djamena (Figure 2). There are two research centers. The center located at Deli (Figure 2) conducts most of the fundamental research on agronomic crops and the applied research on crops and practices useful in the Sudanian (southern) region. This center has been in operation since 1950. Agronomic research designed to assist the Sahelian farmers is conducted at Dougui. (Figure 2) This Center was closed from 1965 to 1975 but work was reinitiated in 1975 with assistance from a FED project permitting construction of several buildings and the clearing of 50 ha of land. The first plantings were made in July 1976. A UNDP/FAO agronomic research

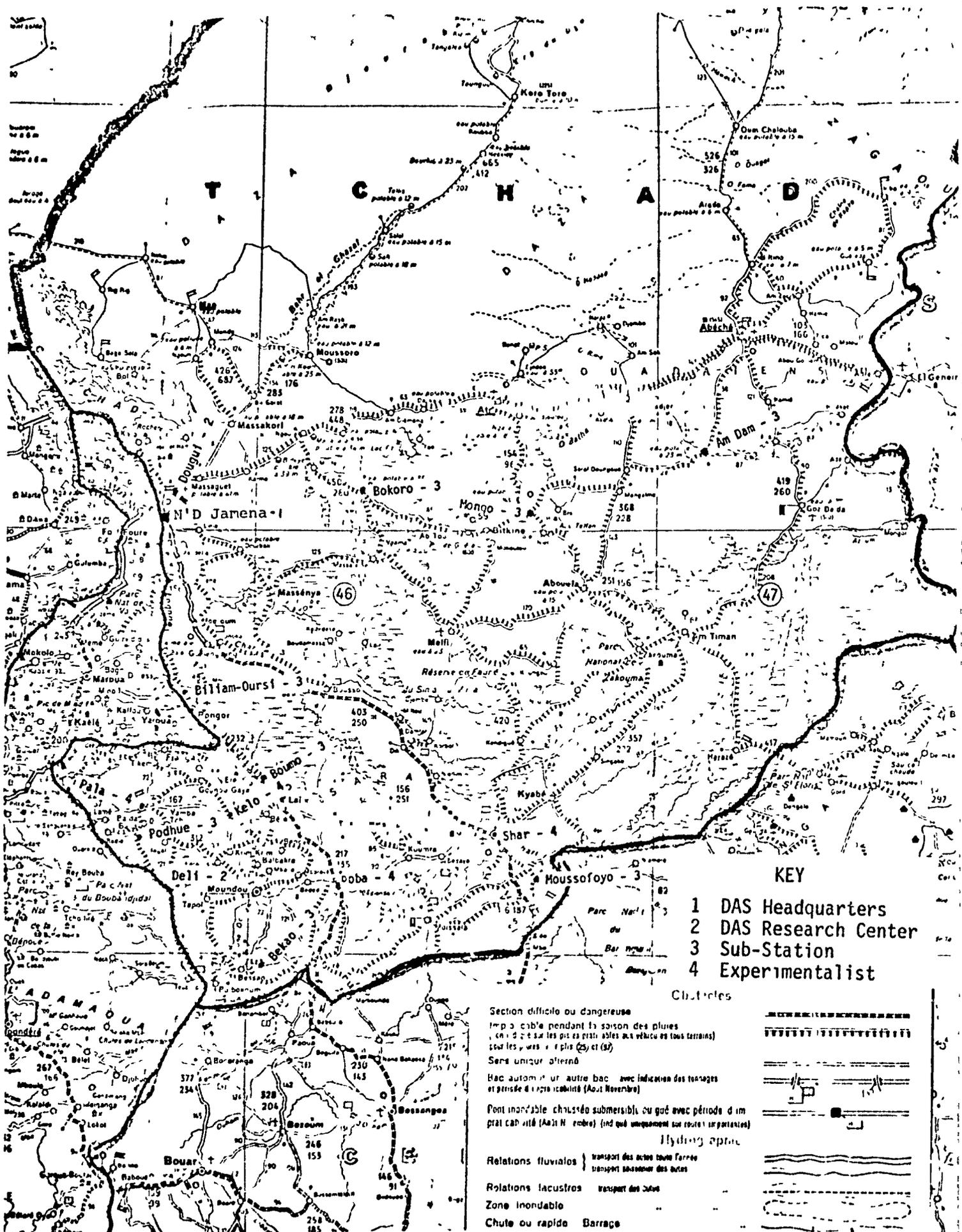


Figure 2. Locations of DAS personnel and activities.



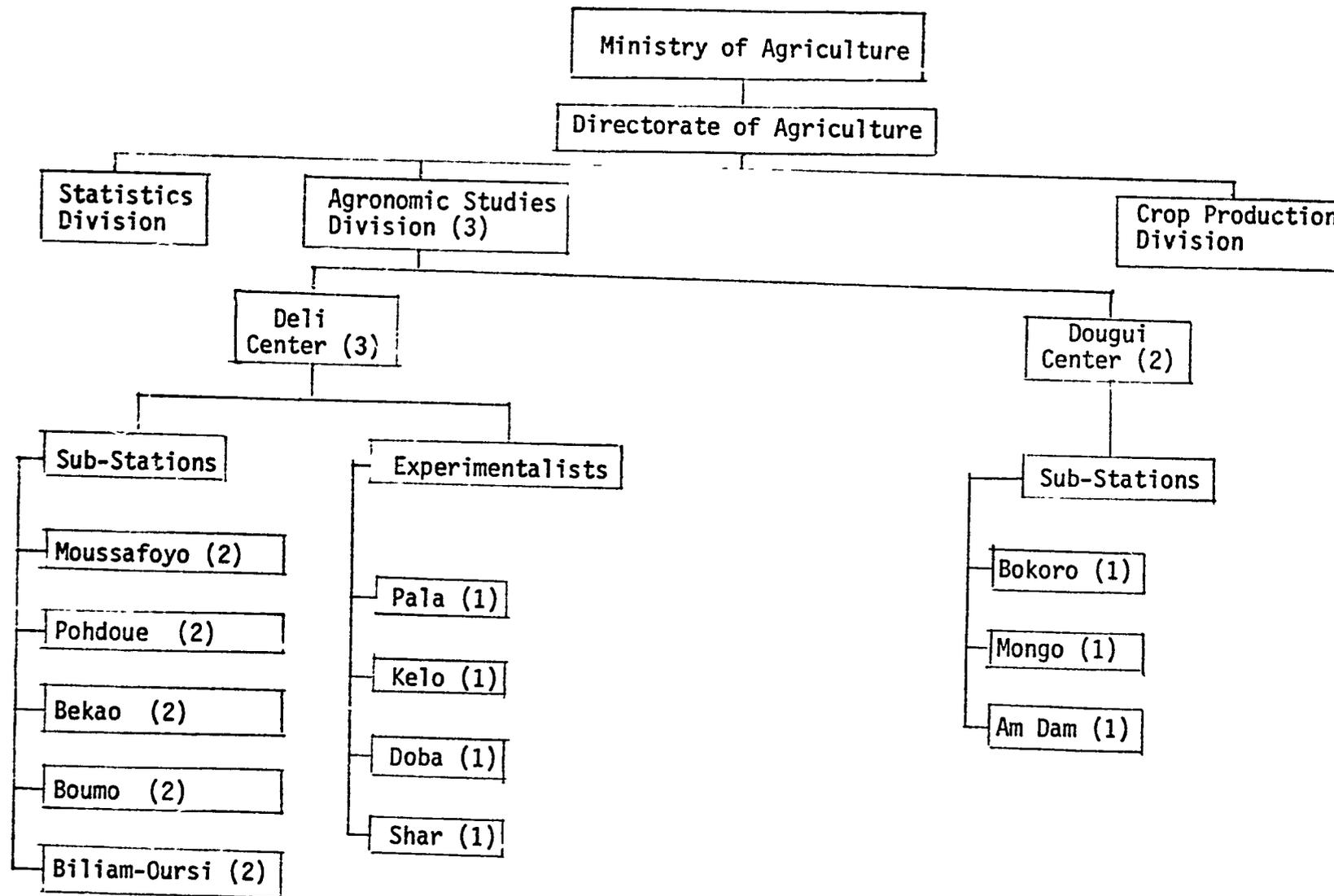


Figure 1. Table of Organization of the Division of Agronomic studies. Number of professional positions at each location shown in parentheses ().

project (FAO 75/005) began implementation in September upon arrival of a Romanian agronomist.

Each of the two centers are further supported by a series of sub-stations used primarily as sites for varietal testing and seed multiplication. Sub-stations operating under supervision of the Deli center are located at Moussafoyo, Pohdoue, Bekao, Boumo and Biliam-Oursi (Figure 2). Three sub-stations operate under guidance of the Dougui center; Mongo, Bokoro and Am Dam (Figure 2). The effectiveness of the later two stations is limited because they are located in the "unsafe" area of Chad. Tentative locations for additional sub-stations to serve the Sahel zone are Ati, Abeche and possibly Cheddra or Mao. (Figure 2).

In addition to the sub-stations in the Sudanian zone, the DAS, using funds provided by FAC, supervises the work of four "village level experimentalists" (Figure 2). Each experimentalist supervises 30-40 farmers who agree to provide all labor in planting, culture and harvest of village level, multi-variable, research plots. The experimentalist is responsible for collecting the data which is submitted to the Deli Center. Each farmer cooperator is paid about \$35 for his labor. This program is presently funded through 1980.

Research on cotton is conducted by the Textile and Cotton Research Institute (IRCT) located at Bededjia. This French organization is administratively and economically independent of the M.A. A sister organization, COTONTCHAD, supplies farmers "in-kind" credit to obtain production inputs and then purchases all production. The IRCT has developed effective linkages between their research program and the Chadian extension service (ONDR).

2. Trained Personnel

The shortage of personnel having training in agronomic and related sciences is a most serious impediment to accelerated development of the DAS. On the other hand, the DAS professionals (BS, highschool or junior highschool graduates) encountered were all very perceptive and had an excellent understanding of their assigned responsibilities.

On paper, the Director, Assistant Director of DAS and the Chief of each center and sub-station should have at least a B.S. degree; the assistant chiefs of each field station should have a certificate from the agricultural high school. In reality, the training level is one or more steps below the indicated levels. The information available indicated that only the DAS Director and the Chief of the Deli center had B.S level training. One technician is in Canada and scheduled to return with a B.S. in May 1977. Reportedly, the DAS Director accepted a position with COTONTCHAD starting in November. The inability of the GOC to pay competitive salaries is the root cause for a high rate of turnover in trained personnel.

3. Facilities and Equipment

(a) Headquarters (N'D Jamena). The DAS headquarters staff occupies two offices in the Ministry of Agriculture building. Being sparsely equipped much of the space is used for filing the reports and reference materials in bulky "pigeon hole" type files. Routine office supplies are "always in short supply" due to budgetary restrictions. A nominal amount of office equipment and supplies should be supplied as part of the project.

(b) Deli Center (Deli) - The Deli research center was started in 1950. At present there are slightly more than 100 has under cultivation and "additional land could be obtained if needed." Since its initiation the

station has received most of its operational support from the GOC but FAC funds have been used to support construction and equipment purchase.

Permanent buildings at Deli include two office-laboratory buildings (approx. 5 x 30 M), four staff houses, a barn for oxen, an equipment shed and repair shop (approx. 10 x 50 M), a general storage shed, a partially covered drying floor (approx. 20 x 30 M) and four 5-MT steel bins. Most of the buildings are in need of maintenance.

Mechanical equipment available, though not all operational, includes four tractors, two off-set discs, two standard discs, a 4-row planter, 5-ft. tractor mower, grain drill, bush-hog, 2 bottom turning plow, two pick-up trucks and three yolk of oxen with equipment. The repair shop is reasonably well equipped, and capable of repairing most of the equipment when spare parts can be obtained. Most of the farming equipment is from Italy (Fiat).

(c). Dougui Center (Dougui)

The 1824 has. farm was set aside sometime during the 1960's however, it was undeveloped until 1975 when an FED project sponsored the construction of the following permanent facilities: 3 room office, barn, garage, machinery shed, hand implement storage and field lab., houses for the Chief and his assistant, duplex house for other trained staff, concrete lined hand well (45M) and metal water tower (no pump).

The site was selected based on a study by ORSTOM because the sandy soils are typical of the zone served by the farm which includes an estimated 30,000 ha of land under cultivation. Dougui is the research center for the Sahel zone.

At present 40 has. of land are used for experimentation and seed multiplication. It is planned to clear additional land at the rate of

50has/year until about 400 has. have been cleared. The cost of land clearing and preparation for first planting was estimated at \$400/has. Therefore, expansion is dependent upon availability of funds to pay labor.

The equipment on hand included one Massey-Ferguson tractor (est 40 HP) with planter and disc; an assortment of hand tools for hand cultivation and hand clearing; two sets of oxen (no equipment) and a land rover supplied by the FAO project.

(d) Sub-stations - Reportedly work conducted at the active sub-stations is accomplished almost completely with hand labor or "hired" animal traction equipment. Usually there is one permanent building which serves as an office and for supply storage. None of the sub-stations were visited since four of the five in the south were inaccessible due to poor road conditions and the only active sub-station (Bokoro) in the Sahel was unmanned.

4. Research Program

(a) National level - The primary function of the Headquarters staff is that of planning, administration and summarization of the research results submitted from the two centers. Primary emphasis has been placed upon conducting agronomic research which utilizes moderate to high levels of chemical inputs. The basic research techniques followed appeared valid, however, the overall orientation of the program was judged as not being directed toward resolution of the immediate problems faced by the Chadian farmers. The shortage of trained personnel appeared to limit effective planning and, more importantly, the capability to analyze and interpret the data obtained. There was less than intense interest on the part of the research staff to prepare and distribute

written materials for use by extension or other educational organizations.

Considering the very limited budgetary support, the shortage of personnel trained in research techniques and the high rate of personnel turnover (three division chiefs during 1976) the DAS is more productive than one might expect.

(b) Deli Center - The research emphasis at this center has been and is upon varietal selection and development and crop rotations. Several agronomically superior varieties of sorghum have been developed and released, however, these varieties have not been widely accepted because they failed to meet the taste preference of the consumers.

Extensive varietal comparison tests are conducted each year on millet, maize, peanuts, sorghum and rice (dryland) both to evaluate local selections and varieties introduced from external breeding programs.

Various crop rotations are under evaluation most of which include cotton since it is the only crop to which farmers add chemical fertilizers. Only during the last two years have perennial legumes been added to the rotation studies. No recommendations concerning specific rotations were available. It was noted that the crop following cotton always benefited from the residual fertilizer, however, at least in the area around Deli and northward it was noted that cotton was grown as a plantation crop in rather large blocks of land while the food crops were generally grown near the villages.

Some land at the center is devoted to the evaluation of "new" crops i.e. soybeans, sunflowers. With slight modifications and depending upon the budget the Center chief assumed that generally the present program would continue.

(c) Dougui Center: This is the first year of actual planting and was drier than "normal" (500mm) which caused a delay in planting until July 7. Major emphasis is on peanuts, the major cash crop of the zone, however, studies are being conducted on sorghum, millet, cowpeas, and chickpeas. This year 4 has were devoted to varietal evaluation and fertilizer trials. Forty-five lines of peanuts (mostly 90-110 day maturity); 30 lines of sorghum (white seeded); 30 lines of pearl millet, and 5 lines of cowpeas were tested. Each test consisted of 6 replications with 4 row plots.

The peanut test was being dug and yields of the better lines will probably yield in the range of 400-500 kg/ha. The Sorghum and millet plantings were severely damaged by the dry weather with many lines of the sorghum never reaching the head stage. Seed set on the millet was poor. Cowpeas had been picked but yields had been severely reduced by field mice. Head smut was observed in the millet.

Thirty-four has. were planted to two varieties of peanuts, one local selection and one introduction from Nigeria.

Seed materials for the variety trials consisted of local selections made by the center Chief from surrounding villages, and introductions, provided through an informal regional accord which promotes intercountry exchange of improved cultivars. As an example in sorghum, five of the lines under test were developed by Pioneer Seed Co.'s International Division and two lines were from the AID/TAB/Purdue sorghum project. It was not possible to distinguish between the fertilized and non-fertilized plots, probably because of the dry weather.

Following the established policy, data from all field research are tabulated and sent to the DAS headquarters in N'D Jamena for compilation

and interpretation, the actual results being returned later in the year.

Planning for 1977 and subsequent crop years has been initiated with considerable expansion in the scope of work with support from the FAO project. In addition to varietal evaluation, studies are being planned on dates of planting, including plantings in dry soil; plant population and maturation studies; incorporation of available organic residues, manure was being collected and composted; low level use of chemical fertilizers, and crop rotation studies. The rotations to be compared initially are (a) peanut-sorghum - 2-year fallow (traditional) (b) 2-year peanut - 2-year fallow (c) 2-year sorghum (millet) - 2-year fallow (d) peanut-sorghum - 2-year perennial legume fallow.

Both the center Chief and the FAO expert appeared well attuned to the current problems encountered by the farmers and competent of conducting agronomically reliable experimentation of the scope outlined. The FAO project includes expansion in terms of an entomologist in 1977 and a plant-breeder during the third project year.

5. Transfer of Technology To Change Agents

Under present administrative and policy procedures the output of the agronomic research program is verbally transferred to the ONDR during an annual meeting between DAS and ONDR personnel. The appropriateness of the information exchanged was dependent upon the organizational head with whom one conducted the interview. Regardless of the reasons, it was evident that a serious weakness exists in the needed linkage between the research and extension organizations.

Unlike the relatively successful technology transfer system used by the cotton program, the DAS has not established for various reasons a

series of field days, short term training seminars, explanatory bulletins or farmer level demonstrations using technologies within the capability of the average farmer.

Because the Chadian farmer must be a risk-averse to survive economically and physically any new agronomic technology or package of technologies must be evaluated more critically in terms of the economic risks for both the inputs required and potential markets for excess production. The implication made from the experience gained through the cotton program is that the Chadian farmer will implement new technologies, which raise his food crop productivity level above subsistence level, only when he is confident that his added labor and costs will be rewarded in economic terms. This is particularly true in the more potentially productive Sudanian region where food shortages are not common. Thus, though "weak", when measured against contemporary standards, the technology transfer system may be adequate for the present need.

III. DESCRIPTION OF THE PROPOSED AGRONOMIC RESEARCH SUB-PROJECT.

One of the essential programs necessary to assist Chad to provide food for its people and augment her poor farmers' limited cash income is to further develop its agronomic research program to a level that it responds to the needs of the farmers who produce food crops. Thus, this sub-project is designed to develop the capabilities of the personnel of the DAS research section to develop and service efficient food crop production techniques and packages; support all Chadian food crop production efforts with technical and research demonstration services, and interact with professionals in adjacent countries in the exchange of useful agronomic research.

Within the initial five years of this project the DAS should develop a small but technically competent, "mission" oriented (problem-

solving) field research team investigating those crop husbandry practices within the reach of most farmers leading to increased production of the major food crops, fully supported with the essential equipment and facilities to have:

a. identified and distributed seed of efficient, adapted, superior varieties of Chad's major food crops;

b. developed or adapted efficient, low-level-input cultural practices for food crops suitable to traditional farmers and compatible with the ecological balance;

c. the capability of preparing and conducting specific coordinated research projects designed to resolve the major crop production problems of the farmer;

d. the leadership and consultative capability to service village scale, farmer implemented, demonstrations of research results;

e. planned and scheduled field days for farmers and change agents at the research centers and their sub-stations;

f. biannual training seminars for the ONDR sector chiefs; and

g. established linkages with the agronomic research programs in adjacent countries and international centers for the purpose of exchanging and evaluating "exotic" germ plasm, introducing new technologies and contributing to technical programs in Africa.

The success of the project may be verified by qualified technical personnel through examination of research proposals and their results; the number and quality of research publications; active participation in cooperative, regional, varietal trials; reactions and observations of ONDR agents and farmers in the target zones. It should be noted that USAID/Chad is in the final preparation stages of a project paper (Ag-

gricultural Institutional Development Project) which includes provision specifically for increasing the GOC's extension service's (ONDR) capability to amplify implementation of the desirable techniques and packages.

These specific sub-project goals are attainable providing the technical assistance technicians are available on schedule; the participants return from various training activities as planned; an active, institutionalized cooperation exists between the DAS, ONDR and related production organizations; political differences do not interrupt the free exchange of information and seed materials with other countries, and the food grain marketing system is developed sufficiently to motivate farmers to produce more than is necessary for their own subsistence.

As a result of the technical advisory and financial inputs into the project, the DAS will be staffed with three agronomists^{1/} capable of planning, implementing and evaluating research activities having a direct bearing upon existing problems; five technicians trained to conduct applied research and evaluate its suitability for recommendation to farmers, ten research technicians having the expertise to assist with the design, implementation and supervision of off-station trial and research demonstration programs, and two technicians with the ability to conduct and correlate laboratory soil tests and make fertilizer recommendations.

^{1/} It is recommended that one of the two Engenieur de Travaux Agricoles presently employed by DAS be selected at the earliest possible date for training to the MS. level. This man could be funded by the African Manpower Development Project. It is suggested that he can be trained at a Land Grant University having an active dry land sorghum breeding and crop production program.

Resulting from these educational opportunities and working under the guidance of experienced advisors, DAS personnel should intensify the screening of local and introduced cultivars (cultivated varieties) of sorghum, millet, corn, peanuts, cowpeas and rice during the project's first crop year; conduct comparative yield trials combining the best available varieties with the identified, farmer-implementable changes in cultural technology, and be demonstrating the value of the improved varieties in selected off-station target areas by the second crop year.

During the third project year the best available technical package or packages should be subjected to both farmer and economic evaluation at the village level, under close supervision of DAS agents. Using superior varieties and simple but improved cultural techniques, a few, innovative farmers in the target areas should adopt the simple technological package by the project's fourth crop year. During the project's fifth and subsequent years the DAS will provide the small farmers with tested, farmer implementable and continuously improving technological practices which will be made available and demonstrated to both the responsible change agents and farmers.

An important project output, in conjunction with the FAO project at Dougui (Annex A), will be further development of two, more functional research centers where the DAS research personnel will have the "tools" to conduct specific, coordinated, low-level input, crop management, varietal selection and crop protection research projects. The combined training and experience of the DAS staff will permit them to develop a long-term strategy and provide guidelines for continued improvement in agronomic research for Chad.

To achieve the above project outputs, it will be necessary for AID to staff the project with experienced, French-speaking agronomic specialists;

construction of the major support facilities must be completed during the initial project year; the essential commodities must arrive on site as needed; the adoption rate of the farmers must be near that experienced in other African countries; and the FAO project 75/005 must be continued and the anticipated follow-on project approved.

The research sub-project will pair teams of Chadians and American agronomists at three locations. The management team will be located at DAS headquarters in N'D Jamena. The other teams will be formed at the Deli and Dougui research centers. The project must be negotiated in sufficient detail to assure unrestricted two-way cooperation between DAS and ONDR personnel at all levels of government and in all regions in which project personnel will operate.

a. N'D Jamena Team: One AID advisor will be stationed at N'D Jamena. He will be co-located with his Chadian counterpart, the Director of the Department of Agronomic Studies (DAS). This advisor's primary responsibilities will be; (1) to assist in the further development of the research planning, management and evaluation capabilities of the DAS, (2) serve as the coordinator with interfacing AID projects (eg-IRD, Agricultural Institutional Development, and the regional Crop Protection) and (3) serve as Chief of the contract party. This advisor must be the first advisor on-station.

b. Deli Team: Three AID research advisors will be stationed at Deli, the principal research station. One will concentrate on varietal introduction, development, evaluation and plant culture of rice, sorghum, millet, peanuts and cowpeas. One will concentrate primarily on soil fertility and conservation research and determination of plant response to chemical inputs which maximize economic returns. The third

advisor will concentrate on the development of production practices and technology packages and work with off-station DAS and ONDR personnel in their experimental and demonstration activities.

c. Dougui Team: One AID agronomist will be stationed at the Dougui station. He will collaborate with the Chadian/FAO research team working there, principally to serve in the development of the off-station testing and village level demonstration program which, unlike in the Sudanian zone, has not yet been tried among the Sahelian farmers.

d. Consultants: A series of short-term consultants will be needed to supply specific support to the Chadian/American team in such areas as production economics, engineering design, pathological and entomological problems. The specific consultant needs can only be determined after the advisory team is on station.

IV. TECHNICAL IMPLEMENTATION

A. Organization and Management - The chief of the DAS and the Chief-of-Party of the American advisory team should be co-directors of the agronomic research sub-project. Likewise, the senior member of the three man advisory team at the Deli center should act as counterpart for the Chief of that center. The relationship of the production agronomist recommended for Dougui should not be determined until a decision is made concerning continuation of the FAO project. Regardless of the FAO project's status, this technician would be responsible to the American team leader.

The technical assistance personnel could probably best be provided through an AID/land grant university contract, though it is not likely that any one university will have sufficient numbers of french speaking agronomists. It is doubtful that it will be possible for any organization to assure five years of continuous service in Chad without rotation

of personnel, however, the minimum term of service should be two years. Previous experience in tropical or dry land agriculture is highly desirable for personnel to be assigned to Deli and Dougui, respectively. The Chief-of-Party should have administrative experience.

Successful implementation of this sub-project will require professional competence, "missionary zeal" and patience on the part of the advisory team supported by responsible commitment and understanding among the AID/project manager, the CDO and the contractor. Anything less than perfect harmony among the entire American team, will seriously magnify the importance of differences normally considered minor under less severe circumstances.

It is essential that both the contract technicians and their spouses achieve the FSI S/R 3 level of French language proficiency to be effective at their posts. Therefore, only technicians with promising language aptitude and in excellent health (including their families) should be recruited. The Deli center is in a remote location but accessible from N'D Jamena by combined commercial airline (Moundou) and land vehicle over 50 km of dirt road. Limited medical services are available in Moundou, however, serious medical problems will require evacuation to Europe.

Principle means of communication to Deli is through telegraph, therefore, consideration for establishment of a side band radio network, possibly to include the sub-stations, should be given by the PP team as a major means of circumventing the travel difficulties during the growing and harvest seasons.

A key factor to the progress of the project will be the selection of mechanical equipment which is both functional and easily maintain-

able. Waiver of U.S. procurement requirements for some items, most likely vehicles, will be necessary. A minimum of six months lead time should be provided for arrival of commodities and, if possible, even longer for construction of advisor housing at Deli. The AID project manager could submit complete PIO/C's for construction and first year commodities as soon as the Pro Ag is signed.

B. Program Emphasis

A primary purpose of the initial phase of this GOC/USAID technical assistance sub-project should be to develop the institutional capability of the DAS to more effectively service the agricultural sector of the Chadian economy. To achieve this purpose both the Chadian and American technical personnel will have to evaluate the existing program and policies and then reorient the future program, as necessary, in such a manner that positive answers can be given to the following criteria, posed as questions.

- a. Do most of the research projects seek answers to the immediate problems of Chad's farmers?
- b. Will each recommendation proposed have a positive economic impact on the total farm enterprise?
- c. Is the emphasis of research on food crops for which there is both a need and a market?
- d. Is the adaptive research outreach program conducted in cooperation with the extension program at a number of widely scattered locations?
- e. Does the GOC budget support agronomic research at a level sufficient to retain competent personnel and provide them the necessary supplies and equipment.

- f. Is training in research methods associated with the conduct of most projects?
- g. Do specialists from different scientific fields have an opportunity to cooperate on the same projects?
- h. Are the primary research centers located in the areas of highest agricultural potential?

At present, a positive response can be given only to criteria (f) and (k), based upon the discussions with Chadian officials and technicians and field observations. The most rapid return on an investment in agronomic research appears to be possible by placing emphasis upon criteria (a), (b), and (d). The project outlined in Section III of this report and in the body of the PRP has this emphasis.

Initially an effective review and evaluation of the backlog of information gained from completed research could possibly permit some useful, tentative recommendations to be made. This review combined with visits to IITA, WARDA and possibly ICRASTAT for the purpose of on-site reviews of applicable current research and more firmly establishing linkages between Chad and these organizations is recommended. The agronomists stationed at Dougui should be permitted to visit the USAID/Niger research project at Maradi which started in 1976.

Without ignoring the long term needs of Chadian agronomic research among the first outputs of the research sub-project should be adaptive research designed specifically to solve the production problems of the Chadian farmer using only those devices and inputs available at the "sous-prefect and village level i.e. hand labor, seed treatment, date of planting, plant spacing, mulching, weeding, etc. Given the present input supply, credit and grain market systems, the use of fertilizers,

pesticides and mechanical traction equipment are not feasible for production of the food crops. The existing research indicates that crop yields can be increased by 100 to 300% by using modern technology and inputs. Thus, the solutions which should be supplied by the research program concern those simple improvements which will minimize yearly fluctuations in yields of the individual farmer while increasing the national productivity at a rate equal to the capability of the market to pay a fair return for the excess production of the commercially oriented farmers.

Strengthening the agronomic research-extension education information exchange system is a need recognized by officials both within and outside the M.A., though not specifically by the DAS and DA leadership. However, research results without utilization, regardless of their validity, waste Chad's scarce financial and trained manpower resources.

Discussions with DA, DAS and ONDR officials strongly implied that elimination of the technology transfer bottleneck would require greater cooperation among the concerned GOC organizations than now exists. Further, the establishment of a research outreach program would, at least during the first five years, have to be funded by external grant funds.

The research outreach program outlined below represents a consensus of ideas from leaders from the DA, ONDR and this consultant. The specific development of this phase of DAS program can be made during preparation of the Project Paper since funds for its development are provided within the budget of the P.R.P. The research outreach program neither duplicates nor replaces the present DAS village level "experimentalist" program discussed in Section II (Current Situation).

The research outreach program would consist of three major phases; (a) field days at research centers and sub-stations (b) training seminars (2-3 days) for ONDR Sector Chiefs and (c) village-scale demonstrations.

The field days would be scheduled and promoted at a time, probably near the end of the growing season, for the benefit of those farmers extension agents and others living in the immediate vicinity of the center or sub-station. The objective of these field days should be to develop a greater exchange of ideas and information between research, extension and farmers but also to give the innovative farmers an opportunity to observe some of the potential benefits of adopting new technologies.

The training seminars would be held, probably during March or April, specifically for the purpose of giving detailed information to ONDR Sector Chiefs and Instructors from the agricultural schools. Such seminars should include detailed demonstrations of new practices, provision of simple visual aids, etc., which could be used by the participants to train those working under their supervision. Both field days and training seminars are used effectively within the cotton program at present.

The "research" village demonstration program would provide a direct DAS-ONDR-Farmer linkage not presently available in Chad. Working under supervision from the two DAS centers, three agents attached to each center, the village agents would live in or near the one or two cooperating villages to provide year around technical assistance to all farmers of the village(s). Only those technologies requiring inputs readily available to and implementable by the farmers would be demonstrated. No attempt should be made to obtain statistically valid data, as with the

"experimentalist" program, although, the village agent should record farmer reaction to changes in cultural practices and family reaction to eating quality, storability, and related factors.

ONDR Sector Chiefs and the Sous-Prefects in whose zones the villages lie must be included in the planning and implementation of the village level demonstration program. Working in cooperation the ONDR Sector Chief, a series of ONDR agent training and farmer observation days should be scheduled throughout the growing season.

The village agents would be supervised and assisted by the general agronomist (with American counterpart) responsible for the total research outreach program at each Center. The general agronomist would, as his research responsibility, have a major responsibility in the evaluation of the various technical practices tested and selection of the specific practices to be demonstrated at the villages.

To be successful the research village demonstration program must (a) be specific to the farmer's actual interests and needs, (b) respect the farmers intelligence, (c) concentrate on single or at most two or three simple new practices with explanations of why the practice is superior and exactly how it is done, (d) include only practices that the farmer can implement immediately (e) be technically sound and economically profitable, and (f) be staffed with village agents who "fit" the social patterns of the village in which they work.

Implementation of the research outreach program will provide an excellent means of linking the institutional agronomic research program to that of the educational programs of ONDR, the agricultural training schools and other bilateral programs (IRD) as they may be developed. In contrast to the research centers and sub-stations of the on-going research program, the villages selected for the demonstration program should be

changed periodically (every 4-5 years).

SECTION IV. NOTES FOR THE PP TEAM.

A. Other Donors

In addition to the FAO project 75/005 (Annex A to the PRP) and the IRCT (cotton) program there are at least two other donor programs which have a relationship or information of potential usefulness to the proposed research sub-project.

The ORSTOM, a totally French pedology and hydrology research and service organization, has a country headquarters in N'D Jamena. By May 1977 they will have completed detailed pedological maps (scale 1/200,000) and descriptions of the entire cropping zone of Chad. Additionally, this organization has recently signed a contract with USAID/C to conduct a complete hydrology and water quality study of the ground water in the Bol polders project area. The country director also indicated interest in providing graduate level training in pedology and hydrology if suitable candidates could be located and was of the opinion that soils analysis laboratory technicians could be trained.

The Chinese Peoples Republic has a rice research and production program at Bongor. As is typical of the Chinese, all aspects of this program are closely controlled by Chinese technicians and there is, at present, no outreach program of any kind.

B. Soils Testing Laboratory

The justification for a national soil testing laboratory was submitted to AID/W in the form of an A/PID in June 1976. To date, no known action has been taken on this request. Because of the necessity for information about soil fertility, pH, organic matter, etc., \$195,600 were included in the PRP budget to support two technicians, build,

equip, and operate for the first five years, a modest but complete soils testing lab at the Deli center. At present, there are no soil testing facilities available in Chad, although, CRSTOM will for a fee conduct partial analysis on a limited number of soil samples. Soil samples, primarily from the cotton program, are presently sent to France for analysis.

Although there may be many sources of information concerning the equipping and operation of soil testing facilities in remote areas, the best source known to this consultant is; Agricultural Environmental Systems, 1319 Ridge Rd., Raleigh N.C. Phone # (919) 782-9590.

APPENDIX I

Consultants Itinerary & Contacts

- Oct. 4 Travel to Wash. D.C. AID/W Briefing
Lloyd Clyburn
Nate Fields
Norman Ulsacker
- Oct. 4-6 Travel to N'D Jamena, Chad
- Oct. 7 Briefing on USAID/Chad programs
John Lundgren Country Development Officer
Sol Sherman Asst. Program Officer
Robert McAlister PRP Teams Coordinator
Art Thieson IRD/PRP Team Coordinator
- Introductory meetings
Director Lere - Directorate of Agriculture
Jean-Marc Peysson-Administrator of Studies
and Programs-DA
- Oct. 8 Introductory meeting
Director Wardougou-ONDR (Extension Service)
- Oct. 9 Review of Agricultural zones, topography, soils and climate of Chad.
Jack Morris Ag. Office USAID/C
- Oct. 10 Free time
- Oct. 11 Visit to Dougui Research Farm
Saïd Brahin, Chief of Center
Rusnac Mihai, Chief, FAO Project 75/005
- Oct. 12 Observational visit to sorghum production field transplanted following recession of rainy season flood.
Discussion with Chief, Department of Agronomic Studies.
Moussa Djadimadji
- Oct. 13 Travel to Moundou (Air Chad) and Deli for discussions and observations of the Agronomic Research Center.
Haroun Kabadi, Chief of Center
M. Langarsou, Rural Economist, Ministry of Plan
Bambé Dunsala, USAID/C, interpreter
Inger Husolf, USAID/C, Participant Tng & Handicrafts Officer
- Oct. 14 Travel to Kelo
Observation of crop conditions, cultural practices soils, city markets and discussions with sous prefecture level agricultural assistance programs with the Sous-prefect, ONDR Asst. Sector Chief, DAS "village level" experimentalist, Rep. of GOC rice production program.
Nagoum Yamassoun, Sous-prefect

APPENDIX I (cont'd)

- Oct. 14 Travel to Gounou-Gaya: Observation of crop culture and cultural practices, discussion of ONDR technical information transfer system
Wada Bonkar-Sector Chief, ONDR
- Oct. 15 Travel to Maroua, Cameroun (only land route open to N'D Jamena)
Discussion of problems and possible solutions for implementation of technical programs in Central African Region
"Tex" Ford, Ag Officer, USAID/Cameroun
- Oct. 16 Travel to N'D Jamena
- Oct. 17 Report of trip to PRP team coordinator and discussion of research consultant's input into IRD/PRP.
- Oct. 18 Preparation of trip reports, summarization of information gathered and draft outline of PRP.
- Oct. 19 Outline and summarize data for first draft of PRP.
- Oct. 20 Draft of project description. Visits to ORSTOM:
FAO; and Administrator of Studies and Programs, DA
Dr. Jean Hervieu, Director ORSTOM
Mr. Kodogbo, Country Director, FAO
- Oct. 21 Preparation of first draft of PRP,
- Oct. 22 Preparation of first draft of PRP
the Director of Vulgarization, ONDR, and the US Ambassador to Chad
Mr. Siniki
Mr. William Bradford
- Oct. 23 Preparation of first draft PRP.
- Oct. 24 Preparation of draft PRP for Agronomic Research, Seed Multiplication and Grain Marketing Project.
- Oct. 25 Completed draft of ARSHGM - PRP.
Consultations with IRD/PRP team leader and Agronomist
Dr. Heitz Gratz, Agronomist, IRD Team
- Oct. 26 Review of draft PRP with USAID/C Program office and Technical personnel
Mack Prosser, USAID/C
Stefan Krashevski, USAID/C
Dick Delaney, USAID/C
- Oct. 27 Rewrite and adjust PRP according to USAID/C requirements.
- Oct. 28 Depart N'D Jamena
- Oct. 29 Arrive Mississippi State

Logical Framework
(Goal and Purpose)

Goal	Measures of Goal Achievement	Means of Verification	Assumptions
<p>1 To strengthen and modernize the country's agricultural area so as to enable it to increase food production</p>	<p>1 Significant reduction in the need to import food grains 2 Significant increase in the per capita income of small farmers in target areas</p>	<p>1 National Crop estimates 2 Monitoring of project outputs</p>	<p>1 GOC will introduce and maintain policies (licensing, taxation, etc.) favorable to utilization of new technology 2 That there will be follow-on projects to implement the outputs of the present projects</p>
<p>Purpose A Agronomic Research To develop the capability on the part of the DAS (1) to design and service efficient food crop production techniques and package (2) support all Gadian food crop production projects with technical training and demonstration services (3) interact with adjacent countries in the exchange of useful agronomic research</p>	<p>End of Project Status A Agronomic Research 1 The DAS should be (a) identifying and distributing efficient, adapted varieties of Chad's major food crops (b) developing and adapting low level input efficient cultural practices for food crops suitable to traditional farmers and compatible with the ecological balance. (c) preparing a 1 connecting specific research project designed to resolve the major crop producing problems 2 The DAS should be (a) producing leadership and consultative services to village scale, farmer implemented demonstrations of research results, (b) presenting scheduled field days for farmers and change agents at research centers and sub stations, (c) conducting training seminars primarily for GDR Sector Chiefs 3 The DAS should have established linkages between its program and existing agronomic research programs in adjacent countries, regional, and international agronomic research programs for the purpose of (a) exchanging and evaluating "exotic germ plasms" (b) introducing new agronomic technologies (c) contributing to regional technical seminars</p>	<p>Means of Verification A Agronomic Research 1 Examination of research project proposals and results 2 Number and quality of publications 3 Active participation in regional varietal trials 4 Reactions of GDR agents and farmers in target zones 5 External evaluation by competent consultants</p>	<p>Assumptions A Agronomic Research 1 That AID curricula technicians are available on schedule 2 That participants return from training activities as scheduled 3 Active, in the organized cooperation between DAS, GDR and related production projects 4 Political differences do not interrupt the free exchange of information and seed materials with adjacent countries 5 The UNDP/FAO project at Douali is funded through 1962 6 The food grain marketing system develops sufficiently to motivate farmers to produce more than necessary for their own subsistence</p>
<p>B Seed Multiplication 1 To increase productivity (yield per hectare) by providing farmers with adequate quantities of improved seed at reasonable prices</p>	<p>B Seed Multiplication 1 75% of farms in target areas use improved project seeds 2 Seed cost per hectare is less than or equal to non project seed costs per hectare 3 Area using improved seed increases from _____ to _____ by 4 Yields in target areas increase as follows Sorghum _____ % Millet _____ % Groundnuts _____ % Rice _____ % Corn _____ % Cowpeas _____ %</p>	<p>B Seed Multiplication 1 Ministry of Agriculture Statistics and Base Line Data</p>	<p>B Seed Multiplication 1 The Government of Chad has made or will make a commitment to support an expanded program for seed multiplication 2 The Ministry of Agriculture will proceed with the establishment and organization of a Seed Division within the Ministry whose sole purpose is the multiplication and distribution of seed 3 The farmers will improve seed and be willing to purchase and plant such seed when it becomes available 4 Other inputs into the agricultural program will be available at a reasonable time 5 Improved seeds are available so that maximum benefits can be obtained from the use of improved seed 6 Security situation will not interfere with the project 7 Weather conditions will be "average" 8 Adequate personnel are available for training to run the project</p>
<p>C Grain Marketing 1 Provide adequate technical facilities for a national marketing service 2 Reinforce the administrative and operational capabilities of the national market service by training personnel</p>	<p>C Grain Marketing 1 Total construction of 5000 MT warehouse space 2 Total construction of 2500 MT of buying station storage space 3 All people trained working in their area of their specialization 4 Ability of GOC to make adequate market and price policy decisions 5 Functional FDR administrative and operational staff</p>	<p>C Grain Marketing 1 Utilization percentage of warehouse space 2 Market research reports prepared for Ministry of Agriculture policy discussions 3 Reports of grain purchases and sales by FDR 4 Time phased reports of warehouse construction 5 GOC cereal grain marketing policies</p>	<p>C Grain Marketing 1 FDR will have available funding for training of trained personnel 2 FDR will recognize their transportation commitment to insure constant flow of grain 3 Government of Chad agrees to place trained management personnel in positions of responsibility rather than use foreign personnel 4 FDR have available funding to become strong purchaser and seller in the food grain market 5 Top level policy decisions will be made in the area of food grain pricing and marketing policies, based upon recommendations and reports of the market research staff</p>

LOGICAL FRAMEWORK
(Outputs)

Outputs	Magnitude of Outputs	Means of Verification	Assumptions
A Agronomic Research	A Agronomic Research	A Agronomic Research	A Agronomic Research
1 Trained Personnel (a) Project Director (b) Agronomic Scientists (MS) (c) Agronomic Technicians (BS) (d) Research Technicians 2 Food Crops Technology Development (a) Improved varieties (1) intensify screening of varieties (2) conduct yield trials of superior varieties in combination with identified, farmer implementable, changes in cultural technology (3) first year of village level, farmer conducted demonstration in target area (b) Improved technological packages (1) first year station trials and economic evaluation (2) first year of on-station trials and economic evaluation (3) early adoption in target areas and farmer evaluation of package (4) improved technology package and rotation system 3 DAS (a) Dissemination of results through (1) field days, (2) training seminars to OADR (b) Fully functional research centers (c) Development of long term agronomic research policy and strategy	1 Trained Personnel (a) 1 (b) 3 (c) 5 (d) 6 2 Food Crops Technology Development (a) Improved Varieties (1) 2 locations (2) 3 locations (3) 4 locations (b) Improved Technological Package (1) 2 locations (2) 3 locations (3) 4 locations (4) 4 locations 3 DAS (a) at 2 locations (1) 2 at 2 locations (2) 2 at 2 locations (b) 2	1 Trained Personnel (a) fifth year (b) third, fourth, fifth year (c) 1 third, 2 fourth, 2 fifth (d) 2 first, 4 second, 4 third, 2 fourth 2 Food Crop Technology Development (a) Improved Varieties (1) first year (2) second year (3) third year (b) Improved Technological Package (1) second year (2) third year (3) fourth year (4) fifth year 3 DAS (a) (1) first year (2) first year (b) second year (c) fifth year	1 Prompt staffing with experiences, french speaking (S/R-3) agronomic specialists 2 Completed construction of major support facilities at Deli by the end of the first year 3 Essential commodities arrive on site as needed 4 FAO project 73/005 is continued and anticipated follow on project is funded 5 Adoption rate of Chadian farmers nearly equal to adjacent African countries
B Seed Multiplication	B Seed Multiplication	B Seed Multiplication	B Seed Multiplication
1 Foundation seed project at Deli fully operable including processing and storage facilities 2 Seed Multiplication Centers at Dougui, Moussafoyo and Biliam Oursi fully operable in (a) Seed Production 1 On farm 2 Through farmer contracts (b) Drying, cleaning, testing and grading (c) Storage (d) Distribution 1. Through OADR 3 Two technicians trained in Seed Technology 4 Four technicians trained in another African country in seed production methods 5 A program for distribution of improved seed to Chadian agencies having direct impact on rural poor	1 Metric tons of annual production, sorghum 200, millet 100, groundnuts 300, rice 300 and corn 100, by year five 2 ___% of farmers in project area receive and utilize direct training in "seed techniques" 3 At least ___% of project seed are made available (via sales) to Chadian organizations that have programs designed to raise the welfare of rural poor	Ministry of Agriculture statistics and base line data 1 That personnel trained and experienced in seed production processing and distribution techniques will become available at the rate equal to the projected increase in volume of operation	1 That personnel trained and experienced in seed production processing and distribution techniques will become available at the rate equal to the projected increase in volume of operation
C Grain Marketing	C Grain Marketing	C Grain Marketing	C Grain Marketing
1 Warehouse Construction 2 Trained personnel 3 Training facility	1 5-1000 MT grain storage warehouses and 10-250 MT grain buying and distribution warehouses 2 17 FDAR marketing specialists trained 3 Technical training center for grain marketing technicians in operation by the second year	1 FDAR records and reports 2 AID evaluation reports 3 Reports of Coordinating donors.	1 Funds available for warehouse construction 2 Funds available for personnel training