The Niger Cereals Project:
An Experience in Technical Assistance

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William E. Hall
Grover E. Murray

Abbreviations

AID	Agency for International Development
CFJA	Centre de Formation des Jeunes Agriculteurs (Young Farmer Training Center)
CID	Consortium for International Development
CNCA	Caisse Nationale de Crédit Agricole (National Agricultural Credit Fund)
CNRA	Centre National de Recherche Agronomique (National Agronomic Research Center)
CPR	Centre de Promotion Rurale (Center for Rural Training)
FAO	Food and Agriculture Organization of the United Nations
FSF	Foundation Seed Farm
GON	Government of Niger
ICASALS	International Center for Arid and Semi-Arid Land Studies, Texas Tech University
ICRISAT	International Crop Research Institute for the Semi-Arid Tropics, India
IITA	International Institute for Tropical Agriculture, Nigeria
INRAN	Institute National de Recherche Agronomique du Niger (National Institute for Research in Agriculture)
IPDR	Institute Pratique de Dévelóppement Rural (Institute for Applied Rural Development)
IRAT	Institute de Recherche Agronomique Tropicale (Institute for Tropical Agronomic Research)
LDC	Less Developed Country
NCP	Niger Cereals Project
OPVN	Office des Produits Vivriers du Niger (Niger Office of Food Crops)
SMC	Seed Multiplication Center

TTU	Texas Tech University, Lubbock, Texas
UNCC	Union Nigérienne de Crédit et Coopératives (Niger Organization for Credit and Cooperatives)
USDA	United States Department of Agriculture

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Introduction

International agricultural development teams inevitably encounter problems and frustrations during missions abroad. The anticipation of such problems, knowledge of the experiences of previous workers and their frustrations, and an understanding of possible evolutions of and solutions for those matters should hopefully help alleviate them and improve the efficiency of a team's operations.

This report is an attempt to record the experiences of the Niger Cereals Project team of the Consortium for International Development (CID), under the coordination of the International Center for Arid and Semi-Arid Land Studies (ICASALS) at Texas Tech University, during its U.S. Agency for International Development (AID) contract from 1976 to 1980.

The Niger Cereals Project (NCP) was a major project financed by the Agency for International Development to assist the Government of Niger (GON) in increasing cereal production in Niger. The AID grant was designed to assist in several interrelated areas, including: an intensified adaptive research effort; foundation seed multiplication and multiplication of improved seed for distribution to farmers; expansion of the cooperative structure and expansion and improvement of the national extension capability, including training centers for extension personnel and demonstration farmers; and academic training in the United States and practical training both in Niger and third countries [Contract No. REDSO/WA 76-84, Appendix A, Operational Plan, p. A-1].

Professionally qualified individuals acceptable to both AID and GON were to assist and advise the GON in the carrying out of GON programs for cereals research and development with the AID grant. The original contract provided for 26 months of effective service by each professional specialist, including (1) a two-month period of language training and other appropriate orientation and preparation in the United States as necessary to prepare the individuals for service in Niger, and (2) 24 months of service in the Republic of Niger. Authorization also was provided for a maximum of 20 man-months of part-time consultant services, as agreed upon by AID, to assist and advise the GON with specific problems relating to the GON cereals program.

Provisions were included for the preparation of an annual plan and a tour plan of work by each professional staff member, within 90 days after arrival at post and in cooperation with his GON counterpart. Each plan was to be consistent with the project goals and was able to be revised by mutual agreement between a professional specialist and his GON counterpart and approval of the chief of party, the AID project manager, and the GON project coordinator.

The contract indicated (1) that such a plan would specify the staff members' technical and advisory responsibilities and also any functional responsibilities he might have, and (2) that the professional staff members would be responsible to the chief of party to carry out the terms of the plan.

The contract provided for seven professional staff members. The services they were to provide were described thus:

> Extension Advisor/Chief of Party will assist and advise the AID Project Manager and GON Director of Agriculture in matters relating to the operation of the project and will act as coordinator of the contract resources. He will (a) assist the AID Project Manager in program planning and management as it relates to the adaptive research, seed production and multiplication, extension, credit and cooperative components of the Niger Cereals Project (NCP); (b) plan and assist in the coordination of the related technical assistance and training program for the NCP needs; (c) monitor and report on the various project activ-

ities in which CID is involved; (d) supervise CID contract personnel to ensure that outputs are produced in a professional and timely manner; and (e) be responsible for the advisory effort to extension component of the project. He will be stationed in Niamey with offices provided in the Niger Cereals Project office.

Assistant Extension Specialist. This advisor will serve as counterpart to the Director of Extension in the Directorate of Agriculture. His prime duty shall be, but not limited to, training. With the Extension Advisor and in cooperation with his counterpart, he will be responsible for planning and implementing in-service training programs, short courses and assist in third country participant program planning. He will also be responsible for assisting in demonstration of cereals and other extension activities. [This position was not filled.]

Plant Breeder. The plant breeder will serve as counterpart to a Nigerien scientist who will direct the Plant Breeding Division of the National Institute for Research in Agriculture (INRAN). This division will identify and develop foundation seed of types and varieties of cereals which are high yielding, drought resistant, and pest resistant and which are better suited for the different climatic and soil conditions in Niger. The plant breeder will be required to plan and carry out the above functions and adapt the research to a package that is usable by local farmers. As a senior plant breeder, he will handle research design and implementation. He will be required to train his Nigerien counterpart to carry on this functional type of research and serve as Team Leader, Research. The Plant Breeder will be stationed in Maradi, Niger, and will be required to direct, with his counterpart, ongoing or designed breeding work at the three sub-research stations to be installed by the GON with project funds. He will be responsible to the CID Team Leader.

Agronomist. The agronomist will work with a Nigerien counterpart researcher in the Soils Management Division of INRAN where major research responsibilities will be to identify soil mineral deficiencies, effective use of fertilizers, and use of legumes and animal manure to

improve soil fertility. Research will include, but not be limited to, evaluation of tillage practices, improved planting practices, crop rotation, and the economic value of fertilizers. The agronomist, in cooperation with his counterpart, will further be responsible for all this type of research at the three sub-stations to be installed by the GON with project funds. He will answer to the Research Team Leader.

Agricultural Engineer. The senior agricultural engineer will work with a Nigerien counterpart in the Division of Agricultural Engineering in INRAN, with responsibilities for the identification of predominant types of soil structures and the potential availability of sufficient sub-soil moisture for irrigation. Other responsibilities will include the design of irrigation systems for use at the National Research Center and the construction of facilities at the Center and branch stations. The agricultural engineer will train Nigeriens in similar capacities and skills. He may also be asked to supply some advisory efforts to Génie Rural in relation to project requirements. He will be based in Maradi and answer to the Research Team Leader.

Cooperative and Credit Specialist. This advisor will be assigned to the national office of the UNCC to design and schedule training seminars and to assist in the design and implementation of various projects to be undertaken by the UNCC. The training seminars will be designed to increase the organization management capabilities of the UNCC officers. Other seminars will be conducted to assess the value of the socio-economic system of different types of credit programs and structures. The advisor should be a specialist in cooperative management and have top-level experience. Additionally, the advisor will assist the Director of UNCC in coordinating the proper use of project commodity inputs and assist the Director on policy and planning matters. He will be responsible to the CID Chief of Party.

Seed Specialist. The senior seed specialist will work with the Nigerien counterpart designated as Director of the Seed Projection and Distribution Program in the Department of Agriculture. The specialist will emphasize the technical and training aspects of the directorate. He

will design and assist in implementing the seed production program, including methods of production, maintenance of purity of production, and volume of production. He will also assist and advise in storage and distribution of seed. He will assist in developing policy with his GON counterpart that will eventually lead to a self-supporting seed program. He will be stationed in Niamey and be responsible to the CID Chief of Party.

The original contract was extended for an additional 18 months of service by six professional specialists between 1 October 1978 and 31 March 1980 in the Republic of Niger. The extension involved several substantive changes in language [Contract No. REDSO/WA-76-84, Appendix A-1, Operational Plan for the period 1 October 1978 to 31 March 1980]:

...to assist and advise the Government of Niger (GON) in the carrying out of GON programs for cereals research and development which the AID grant described above is designed to support. The staff to be provided by CID will work with the designated departments of the government for which AID is providing the financial support. The CID personnel should be oriented where necessary to the background and activities carried out during the past two years and should give special attention to the NCP evaluations as they occur.

CID shall recruit professionally qualified individuals, acceptable to the GON and to the AID, for the positions required....

The CID shall continue to provide consultant services up to a maximum of 12 man-months as called for and approved by the GON and the AID to assist in particular areas identified by the GON and/or the CID and the AID in collaboration with the GON. Depending on the needs, it is anticipated that three months of consulting time will be used to follow up on the work of the CID plant breeder to assure continuity of effort and an effective utilization of the data generated in the first two years of the program. It is also anticipated, depending on the needs, that four months of consulting time will be used in the area of plant, water, and soils relationships and fertilizer application to assure that the inter-

actions are properly considered in the production and multiplication of seed. Other activities may include but not be limited to such areas as: special analysis in the interpretation of soils and fertilizer data, problems of water management, systems of irrigation for plant-water relationship determinations, crop response models, data collection, analysis in the statistical data, assistance in analysis of the impact of the NCP and training of GON personnel....

CID shall furnish such reports as are required under the General Provisions of the contract and within the times specified therein.

Each new member of the professional staff provided by the CID shall, within 30 days after arrival at post, and in close coordination with the GON, prepare and submit to the GON Project Coordinator an annual plan of work. Each plan should be consistent with the regular activities of the service in which the specialist is working and at the same time be consistent with the goals specified in the Project Agreement. Upon approval the technician shall proceed to implement the Work Plan.

CID shall designate a member of the professional staff as contract coordinator and advise the GON Project Coordinator and the AID Project Officer of this.

The professional staff to be provided by CID and the description of the services to be provided thereby are as follows:

A. Extension Specialist: This CID Specialist will be assigned as an advisor to the Department of Agricultural Service. His activities will be particularly carried out within the general framework of agricultural extension in accordance with the priorities defined by the Department of Agricultural Service.

B. Agronomist: The Agronomist will be integrated into the Agronomy Section of INRAN and in particular to the National Research Center at Tarna and will be responsible to the Director of the Tarna Research Center. His responsibilities will be:

- Testing local and new varieties in regards to their agronomic aspects.

- Studying the relationships between cereals varieties -- environment and different farming practices.

- Studying the varietal potentialities in cooperation with the Plant Genetics Section at Tarna.

- Evaluating the farming practices adapted to various ecological conditions and in their relation to plant types.

- Finally, he will cooperate with the section responsible for soil maps in order to provide data that can be relayed to the project zones (seed centers, arrondissements, etc.) the different levels of fertilizers existent in relation to the cereal type and farming systems used.

C. Soil Fertility Scientist: This specialist will be integrated into the INRAN Soils Laboratory at Niamey and will be responsible to the Director of this laboratory. His responsibilities will be:

- Studying the fertility of soils on which cereals will be grown and the means to maintain and eventually increase their fertility.

- He will assist in determining economical fertilizer applications that will be recommended for use by the project according to the crops planted and also according to the type of soil on which they are planted.

D. Cooperative and Credit Specialist: This specialist in Cooperatives and Credits will act as an advisor and will be assigned to the National Office of the UNCC and to assist the UNCC in the training and its refresher training for the village extension

workers and to assist and contribute to the overall programs of cooperative education.

The advisor should be a specialist in cooperative management and have top-level experience. Additionally, the advisor will assist the Director of the UNCC in coordinating the proper use of project commodity inputs and assist the Director on policy and planning matters.

Depending on the priorities of the Director of the UNCC, this advisor would be available to assist in seminars for purposes of assessing the value of the socioeconomic system of different types of credit programs and structures.

E. Seed Specialist: The Senior Seed Specialist will be assigned to the Department of Agriculture Services. He will assist the Director of Agriculture with all problems related to seeds (production, control, distribution, etc.). This assistance will cover production from the research and experimental stage to the final distribution at the farmer level.

F. Agricultural Economist: This specialist will be assigned to the Department of Agriculture Services and will work in close collaboration with the Services of the INRAN and UNCC. His main responsibility will the the socioeconomic analysis of all the activities encompassed by the project. This analysis should lead to the preparation of evaluation reports that will be sent to all the services concerned.

The project was subsequently extended through 31 January 1981, with various members of the project team terminating activities in March, June, and December of 1980.

The CID team for the NCP consisted of an extension agronomist, who also served as chief of party for the first two years; a research plant breeder; a research agronomist; a research agricultural engineer; a cooperative and

credit advisor; and a seed specialist, who served as chief of party the last two years. Several consultants were also utilized during the term of the project.*

In our opinion, the organizational structure of the project was unfortunate. The professional specialists had responsibilities to CID, to the chief of party, to AID, and to GON. Throughout much of the project the professional staff was in limbo regarding its ultimate authority and responsibility and much valuable professional time was wasted by the tripartite arrangement and the uncertainties regarding who was boss and who could "call the shots." The difficulties of maintaining coordination and communication among such groups was obvious. The fact that the role of the professional staff -- specialists -- was modified from one of assisting and advising the GON to one of working in certain departments abetted the confusion regarding authority and responsibility. Contributing to inefficiency were: (1) failure of GON to designate counterparts; (2) carping by both the AID and GON regarding language proficiency rather than placing emphasis on scientific and technical skills; and (3) bureaucratic "foot-dragging" and delays by both AID and GON in securing equipment and in providing approval for appointments of professional staff and consultants.

Note is made that the contract and the goals of the project were established in the spring and early summer of 1976, whereas the CID team, led by Texas Tech University (TTU), was not actually fielded until the fall of 1976 because of language training and other orientation. The CID team had virtually no input into the organization of the project and the establishment of its basic goals. Continued reference in the contract documents to "carrying out of GON program(s) for cereals research and development" fostered the attitude that only research programs conceived by or acceptable to GON were viable. Although this posture was overcome in many instances, much time and expertise were lost in the process.

Historically, the Niger government requested the AID area development officer to explore the possible development projects in January 1974. In February of

*Personnel involved in the Niger Cereals Project are listed in Appendix 1.

that year, a two-man team visited Niger to discuss a major effort of the GON to increase cereals production. A scope of work was written and a design team was sent to Niger in April of 1974 to write a Project Paper. However, the scope of work set project goals and detailed a schedule of events starting with recruitment of staff in 1975, intensive varietal testing in 1976, production/demonstration program in 1977 and continued expansion of the program through 1980.

The Project Paper noted an important feature of the first-year plan of action as the use of short-term consultants from September through October 1974. These experts were to assist AID and GON in the resolution of outstanding issues and decisions on project implementation and would develop detailed work plans for the first two years of the project.

Annex I of the Niger National Cereals Production Project Paper contains project details prepared in 1974. Among other details, it suggests the use of former Peace Corps personnel for assistance on the seed farms. Four or five such individuals were employed by AID in 1975; three were assigned to the seed farms at Guéchémé, Madaoua, and Magaria. Seed farms were delineated and land was cleared for limited crop production in 1976.

A team of three consultants visited Niger from 18 February to 27 May with the expressed purpose of advising and assisting the GON in the development and implementation of a seed production program (1).*

Thus AID and GON had launched the NCP prior to the selection of CID as the project contractor in May of 1976.

Orientation for the CID technicians was started at Texas Tech University in July 1976. They had six weeks of intensive French language courses conducted by the TTU foreign language department. Orientation lectures were also given by technicians and consultants who had previously been to Niger. The team departed from New York for Niger 14 September 1976.

*Numbers in parentheses refer to sources listed in the References section.

The basic objective of the Niger Cereals Project (NCP) was to increase production of millet, sorghum, cowpeas, and peanuts in the Republic of Niger, thereby leading to greater self-sufficiency of food production and improving living standards of the agricultural and rural populations. Each of the team members prepared a plan of work reviewing the specified assignments and proposing actions to accomplish the objectives. These work-plan papers were combined into a single report and submitted to the director of AID/Niamey and to the Nigerien project coordinator within 90 days of the team's arrival in Niger (2).

In addition to technical papers prepared in connection with the team members' activities, monthly and annual progress reports were written and distributed to the Government of Niger, AID/Niamey and CID (3, 4, 5). Each team member also prepared an end-of-tour report which was distributed individually rather than as a combined 1980 progress report.*

At the termination of the project, team members were requested to submit an evaluative perspective paper outlining achievements and failures, describing problems and proposed solutions, and suggesting future programs and activities which would contribute to the agricultural development in the Sahel. This publication presents a synthesis of the final reports prepared by the members of the team.

Much of this book consists of direct quotations from the various papers. Their use is gratefully acknowledged. In order to preserve the cohesion of the team approach, individual credits are not cited. The writer assumes responsibility for the use of partial quotations and editorial interpretations to avoid duplication and repetition.

*The various reports and papers prepared during and as a result of the Niger Cereals Project are listed in Appendix 2.

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Achievements

James E. Williams, chief of party for the first two years of the project, states in his review (6), "The team was a dedicated, hardworking group.... Their presence established a favorable image for CID in Niger and with AID, that none be ashamed of. Individual team member reports will explain in detail their accomplishments, but it should be stated here by the chief of party that the mission was successful and each team member performed in a very professional way."

AGRICULTURAL ENGINEER

Plan of Work: The plan of work proposed by the agricultural engineer, Eugene Foerster, encompassed the construction of buildings at the seed multiplication centers (SMCs), irrigation for the foundation seed farm (FSF), soil and water conservation methods to be researched, and evaluation of animal-traction equipment.

Shortly after beginning the project, the agricultural engineer met with the seed specialist and GON officials to review the construction plans on each of the SMCs. Floor plans prepared by Howard Potts for the Project Paper had to be modified slightly to be appropriate for local-contract construction. The size of equipment and capacity of function and production were maintained, however.

Meetings also were held and agreements were made on farm equipment for the SMCs and foundation seed farm. Equipment orders were placed through the AID purchasing agreement with the American-African Purchasing Corporation.

An office, built at the Tarna Station, was designed by the agricultural engineer, who also supervised the construction. A livestock facility also was designed and supervision was provided for the office, library and laboratory complex, although these were outside the scope of the Niger Cereals Project.

The original irrigation system for the Lossa Foundation Seed Farm was redesigned within certain limits. As originally designed, three liters of water per second were to be distributed simultaneously to each hectare. This would require many man-hours of labor for each irrigated hectare and would also interfere with other operations. The system was modified to provide more water at each outlet by not having all outlets operating simultaneously. An addition to the system was designed to provide for flood irrigation of hectare plot groups at one time. This would allow other production operations to be carried out without interference during the irrigation of other areas.

No work was done to design an irrigation system for the SMCs. The agricultural engineer recommended that supplemental irrigation be considered for the seed multiplication centers. In the design of such a system, a tube well with a turbine pump to fit the irrigation design was recommended.

Soil erosion by water from intensive rainfall occurred at the SMC just north of Maradi. A study was made of the situation and recommendations were made for a contour system of farming.

The dike along the Goulbi River was extended to provide protection of the valley soils of the Tarna Station from the annual flooding of the river.

Water conservation was the main theme of the research conducted. This included the study of such topics as plant response to timed irrigations, response to various levels of irrigation, available water utilization on various slopes, response to tilled and non-tilled soils, response to weed control, response to fertilizers applied at various times during the growing season, and plant density response to available moisture. Additional information about this experimental work is included in the technical reports.

Equipment requested to conduct animal-traction studies was not obtained. Therefore, no studies were made in regard to animal-traction efficiency.

RESEARCH PLANT BREEDER

Plan of Work: The work plan developed by the plant breeder, Clark Harvey, outlined and justified the proposed varietal development and testing program.

Emphasis was placed on improving millet and sorghum varieties. Improvement was described as development of varieties with disease and insect resistance and better adaptations for Nigerien climatic and soil conditions as measured by higher grain yields. He expected to work closely with M.J. Chantereau, GON millet breeder, and Moussa Adamou, GON sorghum breeder.

The short duration of the project -- four growing seasons -- dictated that a new cultivar could not be released using conventional plant breeding procedures. What could be accomplished was the identification of an open-pollinated cultivar that would be superior to those being grown by the farmer and the initiation of a conventional plant breeding program that could be continued by a native counterpart. If properly tested and identified, an open-pollinated cultivar could be released to the seed multiplication program to provide seed for the farmers until a better cultivar could be developed by the breeding program. Both programs could be initiated simultaneously.

With the above objectives in mind, an effort was made to collect the maximum germplasm pools of sorghum and millet within the available time. Efforts were concentrated on the International Crop Research Institute for the Semi-Arid Tropics (ICRISAT) in India and the Texas Agricultural Experiment Station of the Texas A&M University System. Some materials were obtained later from the United States Department of Agriculture (USDA).

After two years of testing on two soil types, 10 open-pollinated lines of sorghum were identified as candidates for release to the Seed Multiplication Program. These lines clearly demonstrated superiority over cultivars previously released through the national program. They were identified and data regarding them were presented in the 1978 annual report (4). The number of

lines could be reduced by further screening through moisture stress tests during the winter and early spring -- the dry season -- where irrigation water was available. The surviving line or cultivar could be used until better ones were identified or developed. Clark Harvey proposed the additional steps to be taken after his departure but the program was not continued.

This type of "crash" program was intended to produce a better performance cultivar for the farmers while new and superior ones were being developed.

Work also was initiated on a conventional plant breeding program. Two approaches were used. One was to make diallel crosses among several lines with the F-1s being grown out and evaluated for additional use in a breeding program. Approximately 100 F-1s were grown out during the 1978 rainy season and the data regarding them are recorded in the 1978 plant breeder report (4). About 50 percent of them exceeded the yield of either parent. Many exhibited heterosis ranging from 16 percent to more than 100 percent greater than the higher yielding parent. These lines had good potential for development into open-pollinated cultivars or as "R" lines to be used in hybrid seed production. It is probable that diallel crosses among the 10 high-yielding lines would have been even more successful.

The other approach, which might be considered conventional, was to cross some of the open-pollinated cultivars into a cytoplasmic male sterile line. Some performed quite well although the results were not as promising as the F-1s.

The plant breeders of Niger were not enthusiastic about developing hybrid sorghums. The NCP program required continued testing of hybrids so that performances would be documented. Because most sorghum-growing countries with highly developed agricultural systems use hybrids, it is possible that within a few years the attitude of Nigeriens may change.

Prior to the release of a variety, on-farm tests -- or verification trials, as they are known in some countries -- are conducted on promising cultivars. The procedure includes the testing of one or two promising lines in tandem with tests on several local cultivars under ordinary or usual farming situa-

tions. Although this procedure had not been followed in Niger, it was implemented later by the agronomist. It is believed to be a good practice because such local on-farm trials can accomplish two major objectives. One is to stimulate the interest of the farmer and his neighbors in the research process, and hence create an early desire for newly released cultivars. The other is to create a link between research and extension by using these trials in a dual role as research plots and extension demonstrations. Unfortunately, in Niger, as in many developing countries, a close linkage between research and extension is not only absent but appears to be difficult to implement in the near future.

In summary, it may be said that the plant breeding program was highly gratifying during the first two years of the program. The results greatly exceeded expectations. Unfortunately, the GON plant breeders were not interested in advancing the superior lines identified by Clark Harvey at the possible expense of their own programs. GON would not request a consultant for advising and evaluating the plant breeding program in the final two years of the project.

The plant breeder also was involved in millet improvement during the 1977 growing season. During that year ICRISAT sent a millet breeder to Maradi, Niger, and a native Nigerien returned from graduate school at Kansas State University. The millet program was continued under their direction.

RESEARCH AGRONOMIST

Plan of Work: The activities and accomplishments of the agronomists are discussed here in relation to varietal adaptability, fertilizer and rotation systems, phosphate utilization, and farming systems. Cyril Brown, the research agronomist, was assigned to Maradi from September 1976 to April 1979. He proposed a work plan including instruction on soil sampling techniques, equipping and using the Soils Laboratory at the Centre National de Recherche Agronomique (CNRA) at Tarna, improving the library and reference facilities, initiating rotation and farming systems research, serving as technical advisor to the director of the National Soils Laboratory in Niamey,

and cooperating with other CID team members in varietal and fertilizer demonstration plots.

Alex Cunard, who held the research agronomist position at Maradi for the period from April 1979 to November 1980, conducted research on farming systems and continued the work started earlier by Brown.

Varietal Adaptability

A nationwide system for the comparative study of the performance of millet, sorghum, and cowpeas was established by the research agronomist, Cyril Brown. The work began in the growing season of 1977 with pilot trials at the Centre National de Recherche Agronomique. During 1978, experiments were laid out at 33 different sites. In 1979, experiments were conducted at 85 locations. In any undertaking of this magnitude in a country the size of Niger, problems are inevitable. Nevertheless, enough data are available from these nationwide trials to allow some statistically sound conclusions.

Rainfall

In rain-fed agriculture, an annual rainfall of 300 millimeters or less will result in poor yields of millet, and the yields will be reduced additionally if nitrogenous fertilizers are added to the soil. With 300 to 400 millimeters of annual rainfall, the distribution and availability of rainfall largely dictate the yield. An annual rainfall of 400 millimeters or more is generally satisfactory for millet production. These interrelationships between yield and rainfall are derived as by-products from a study of cultivars of millet and nitrogen fertilizer in many areas of Niger. They may be fundamental when judged in the context of Charoy's work[1] in which he reported that the water requirement for millet during its 114-day growing season at Maradi was 366 millimeters.

[1] J. Charoy, 1974, Dynamic de l'eau dans les sols ferrugineas tropiqux de'origine dunaire de Tarna et application au mil, a l'arachide et au sol nu. L'Agronomie Tropicale, XXIX No. 8:821-830.

Cultivars

Millet. -- The cultivar of millet P-3 Kolo studied in 1977, 1978, and 1979 did not prove to be the best cultivar in Niger; CIVT generally provided higher yields than P-3 Kolo. Several other local cultivars produced just as well as P-3 Kolo and CIVT at specific locations within the country. However, it must be recorded that P-3 Kolo was first introduced into the field in Niger in 1960, and the CID agronomist found no evidence that its purity was maintained after 1964. CIVT is now in its third year of field testing.

Sorghum. -- The four cultivars had been selected from the GON sorghum breeding nursery by the GON breeder for their high yield record. They were L-30, ½MSB, A_2B_2, and A_4D_4. They had restricted adaptability, however, and performed well only at Maradi and Niamey. This took place prior to Clark Harvey's identification of the 10 superior cultivars, which were never included in the multi-local trials.

Cowpeas. -- During the test period, the selected cultivars of cowpeas proved better than the local cultivars, but the trials were conducted only at four sites. Cultivar T-4-69 is suitable for areas with average rainfall greater than 600 millimeters, and TN-88-63 grew better in areas of lower rainfall.[2]

Fertilizer Treatments and Rotation Systems for Millet, Sorghum and Cowpeas

To our knowledge, the trials conducted represent the first side-by-side field tests of local and selected cultivars in different parts of Niger, although we know that the farmers of several villages had indicated definite preferences for their local cultivars. Thus, some of the reported results are not merely extrapolations which could have been made from studies

[2]INRAN extension notes of 1977 advised that TN-88-63, TN-4-69 and TN-36-64, and TN-98-63 could be planted in rainfall zones with 300-400, 400-500, and 500 millimeters of annual precipitation, respectively.

elsewhere. Rather, they represent the first time that these data have been available in Niger. The various results[3] follow:

1. All local cultivars of millet, sorghum, and cowpeas which were tested responded positively to nitrogen and phosphate fertilizers.

2. ++The response curve of millet and sorghum treated with nitrogen increased with increments of nitrogen up to 90 kilograms, but the curve tended to flatten above 60 kilograms. This leads to the conclusion that the economic optimum may be between 45 and 60 kilograms of nitrogen per hectare.

3. Yields of cowpeas and peanuts increased when they received a "starter" of nitrogen fertilizer. Legumes are not inoculated in Niger.

4. Analytical data for soils showed an improvement in nutrient status for nitrogen, phosphorus, and organic matter when legumes were used in the rotation.

5. ++Green manure reduced the yield of all cultivars of millet in the first year of spreading.

6. ++Pen manure and compost increased yield immediately and in subsequent years.

7. ++Legumes in the rotation always caused an increase in the yield of millet. A legume-millet rotation can increase millet grain by approximately 200 kilograms per hectare; a legume-legume-millet rotation may increase the millet yield by 500 kilograms per hectare.

[3]Credit is indicated for support research done prior to 1976 at Centre National de Recherche Agronomique (CNRA) by the inclusion of the symbol ++; some of that work was discussed in annual reports of the Institute de Recherche Agronomique Tropicale (IRAT) and the Institute National de Recherche Agronomique du Niger (INRAN). See also Cyril Brown, 1980, Perspective of the Niger Cereals Project.

elsewhere. Rather, they represent the first time that these data have been available in Niger. The various results[3] follow:

1. All local cultivars of millet, sorghum, and cowpeas which were tested responded positively to nitrogen and phosphate fertilizers.

2. ++The response curve of millet and sorghum treated with nitrogen increased with increments of nitrogen up to 90 kilograms, but the curve tended to flatten above 60 kilograms. This leads to the conclusion that the economic optimum may be between 45 and 60 kilograms of nitrogen per hectare.

3. Yields of cowpeas and peanuts increased when they received a "starter" of nitrogen fertilizer. Legumes are not inoculated in Niger.

4. Analytical data for soils showed an improvement in nutrient status for nitrogen, phosphorus, and organic matter when legumes were used in the rotation.

5. ++Green manure reduced the yield of all cultivars of millet in the first year of spreading.

6. ++Pen manure and compost increased yield immediately and in subsequent years.

7. ++Legumes in the rotation always caused an increase in the yield of millet. A legume-millet rotation can increase millet grain by approximately 200 kilograms per hectare; a legume-legume-millet rotation may increase the millet yield by 500 kilograms per hectare.

[3]Credit is indicated for support research done prior to 1976 at Centre National de Recherche Agronomique (CNRA) by the inclusion of the symbol ++; some of that work was discussed in annual reports of the Institute de Recherche Agronomique Tropicale (IRAT) and the Institute National de Recherche Agronomique du Niger (INRAN). See also Cyril Brown, 1980, Perspective of the Niger Cereals Project.

8. Crotolaria senegalensis (Gougiya Awakii) has been selected as a local legume which can be introduced during the fallow year in a rotation. Laboratory tests disclose that this legume increases soil nitrogen, phosphorus, and organic matter.

9. ++Although no significant response to potassium fertilizers on sandy soils was observed by Charoy[4] and Brown[5], experiments in the Soils Laboratory in Niamey indicate that a sandy micaceous soil in Niger releases potassium at rates capable of sustaining good yields.

Utilization of Local Phosphates

1. ++Both commercial superphosphate and indigenous rock phosphate from Tahoua increase the yield of millet. However, it takes two or three times more rock phosphate by weight to obtain an equivalent increase in yield relative to that produced by commercial phosphate.

2. ++Phosphate fertilizers have an immediate effect and also a delayed effect which may last as long as 10 years in a millet-legume rotation.

3. ++IRAT's recommendations[6] of 75 kilograms of P_2O_5 as a base treatment every six years with annual dressing of 20 kilograms were substantiated by Nabos, et al.[7] In spite of IRAT's work, available evidence suggests that these levels can be reduced because of the residual effect of phosphatic fertilizers.

[4]J. Charoy, 1976, Syntheses des resultats experimentaux. INRAN Ministere du Développement Rural, Niger.

[5]C.B. Brown et al., 1979, A seven year study of postassium fertilization on a Sahelien soil. INRAN and Texas Tech University.

[6]J. Nabos, et al., 1974, Fertilisation phosphate des sols du Niger, utilisation des phosphates naturels des Tahoua. L'Agronomie Tropicale, XXIX No. 11:1140-1150.

[7]Ibid.

Farming Systems

Intercropping

Intercropping offers a better alternative than pure cropping under peasant farming conditions in the Nigerien Sahel. Some of the factors in favor of intercropping are:

1. The total weight of produce per unit obtained by intercropping is greater than that resulting from pure cropping.

2. The financial return can amount to 100,000 CFA ($500 U.S.) per hectare with an intercrop of millet and groundnut.

3. Dune soils are left in a more fertile state by the presence of legumes. Because the millet crop is of primordial importance to the Nigerien peasant, a pure crop of millet needs to be rotated with a legume. However, a mixed crop of millet and a legume can be followed by another mixed crop of millet and a legume. The peasant can thus grow millet every year on his land without causing deterioration of the soil.

4. High levels of cereal production can be maintained by spot application of small amounts -- 20 kilograms per hectare -- of nitrogenous fertilizer. (Available evidence suggests that much of millet yield from dune soils is due to indigenously available nitrogen.)

5. Resistance to pure cropping is exhibited by many peasants who have realized the value of intercropping.

6. Other advantages,[8] i.e., reduced risk of crop failure, reduction of disease and/or insect losses, and greater efficiency of land and labor.

[8] Alex Cunard, 1979, Annual technical report, part I, sections I and II.

Utilization by Farmers
of Available Resources

Spot replacement of inorganic nitrogen fertilizer (2 grams of urea per hill) at the rate of 20 kilograms per hectare resulted in an increase in yield of 250 kilograms per hectare. This is a yield comparable to that obtained by broadcast applications of 100 kilograms per hectare. One kilogram of farmyard manure per hill, which is an application of about 10 tons per hectare, also resulted in significant increases in yield.

SEED SPECIALIST

A foundation seed farm at Lossa and five seed multiplication centers at Guéchémé, Doukoudoukou, Hamdallaye, and Kouroungoussa were designed and put into production. Houses, offices, seed laboratories, storage and processing buildings, and equipment storage and maintenance buildings were constructed at the FSF and on the Guéchémé, Doukoudoukou, and Magaria SMCs. Seed processing equipment was ordered and installed and the seed laboratories were equipped. Cattle stables were included at the three developed SMCs. Development of the other two SMCs was planned for Phase II of the project. Seed processing facilities should be added only if the program expands and there is a demand for increased seed processing operations.

Two Nigerien training participants received extensive training in seed technology at Mississippi State University and returned to Niger in 1980 -- one as coordinator of the Niger Cereals Project and one as chief of the Seed Multiplication Program.

Three other Nigerien technicians were sent to Cameroon for a three-week seed technology course conducted by Mississippi State University. Upon their return, they were assigned to work as chiefs of the SMCs. Another three Nigeriens visited Morocco and Tunisia for three weeks to study the seed multiplication programs and seed quality laboratories in those countries. On returning to Niger, they were assigned to work as seed quality technicians at the SMCs.

A basic Seed Multiplication Program was formulated and has been used to a limited extent. Breeder seed (M-0) was to be produced and maintained by the research service (INRAN) for distribution to the FSF where it would be multiplied to the M-1 generation. M-1 seed was to be distributed to the SMCs for multiplication to the M-2 generation. Unfortunately, the poor quality of the M-0 seed received from INRAN prevented the production of acceptable M-1 seed by the FSF. Instead, INRAN also provided seed to the SMCs for the production of M-2 seed. By attempting to produce such large quantities of seed, INRAN could not achieve the purity standards required for maintaining M-0 breeder seed, which is essential for the purity in multiplication of succeeding generations. This problem is elaborated in a later section.

Yields of millet on the SMCs in the years 1977 to 1979 varied from 247 to 1300 kilograms per hectare. The yield exceeded 1000 kilograms per hectare on three occasions at various centers. From the years 1975 to 1978, the national average yield, which can be calculated from Reeser's report[9], was 376 kilograms per hectare. This is approximately 50 percent below that of the overall average of 647 kilograms per hectare obtained on the seed multiplication centers.

The amount of M-2 seed produced on the SMCs was more than sufficient to meet the demand of the department productivity projects. In addition, M-3 seed was produced by contract seed farmers in the last three years of the project. Field inspections were made and proper seed multiplication procedures were undertaken. Although quality standards were loose and only a small amount of seed was recovered, the process was a valuable learning experience and revealed many of the problems which will be encountered in future seed multiplication programs in Niger. These problems include the need for isolation of seed fields, the requirement of pure M-1 seed to produce high quality M-2 seed, the necessity of roguing seed fields, the establishment of a premium price to be paid for quality seed, and the supervision, collection, and maintenance of seed purity of the accepted seed fields at harvest time.

[9]Reeser, Robert M., 1980, Economics of agricultural production and improved agricultural practices in Niger based on synthesized budgets. CID report, p. 17.

Field days were held at the SMCs so that local farmers could learn of the seed program and could observe production of the new cultivars. Newspaper, radio, and television coverage assisted in providing publicity for the program.

Thus, progress was made toward the three objectives of the project: (1) development of facilities and a practical organizational structure; (2) training of personnel; and (3) production of seed through practices available to the average Nigerien farmer.

EXTENSION ADVISOR

Plan of Work: The work plan developed by the extension advisor, James Williams, in November 1976 contained a list of essentials for a successful extension program. The listed objectives outlined a suggested extension organization and justified the utilization of six national and 12 departmental specialists. The director of the Service of Agriculture rejected the proposed organization and establishment of an extension branch so procedures had to be changed to work within the existing organization.

John Harvey, extension advisor from 1978 to 1980, reiterated the need for in-service training and educational facilities in his plan of work. He also expressed plans to distribute extension visual-aid commodities and information materials.

James Williams outlined an extension program and organization which, if carried out, could improve the extension program of Niger considerably. He also wrote several basic publications, helped develop a training manual for para-professionals, arranged for and accompanied the chief of extension (chef de vulgarisation) to Nigeria for a study of a successful extension program, and implemented a training program for para-professionals.

Extension programs consisted primarily of disseminating information, providing ideas, and conducting training with the use of every available and appropriate means of communication.

The quantity and the quality of such transfers of knowledge cannot be easily measured. For example, a time lapse may occur between the time of an educational thrust and the acceptance and adoption of the program elements. In addition, the degree of acceptance and the rate of adoption may vary from individual to individual as well as among cultural groups and regions.

The extension advisor carried out the instructions and agreements of the CID contract and advised the director of agriculture and the project manager of the progress being achieved. Some of the ideas promulgated were used immediately, others were used later, and some were not adopted. It is important to note that officials of the Government of Niger (GON) were in charge of their extension program and that they were extremely short of personnel to implement and carry out an extension program. Simply stated, they did not have the manpower to implement some of the ideas at that time.

As part of the 1977 Plan of Work (1 January 1977 to 1 September 1978), the extension advisor recommended that 18 Nigerians -- six national and 12 departmental specialists -- be assigned to help train extension agents and disseminate information. Unfortunately, however, it was not possible at that time to carry out such a recommendation. The plan also included the generally accepted objectives of an extension program, 10 examples of practical program developments, 12 topical subjects for professional training, plans for 10 workshops, and an itemized budget projection.

At this time, the director of agriculture employed 150 para-professionals to work directly with farmers to demonstrate improved farming practices. Demonstrations are undoubtedly one of the best ways to teach farmers because observing and participating in activities is a well-known procedure of training. The aide-encadreurs ("field agents") were given two weeks of training by arrondissement ("district") agents, were provided with fungicide, fertilizer, and seed, and then were sent out to establish farmer demonstrations. Department and arrondissement agents who were responsible for the total agricultural program, including extension, were brought together by the director of agriculture for a three-day workshop. Researchers for INRAN reported on research projects and the director himself presided over the workshop.

Mimeographed publications in French were made available to the chief of extension (chef de vulgarisation) on the following subjects: personnel development; social action; farmers' acceptance of new ideas; millet, sorghum, and cowpea production; extension teaching methods; and themes for extension programs. Publications written by the seed specialist and agronomist were also translated into French and were made available. Outlines for a training program utilizing slides were presented to the chief of extension. One of the better efforts, according to the extension advisor, was a training guide for aide-encadreurs. The project coordinator, chief of extension, and AID personnel assisted in writing the guide, which provided for training, setting up demonstrations, reporting, and conducting field days. The guide was then tested with aide-encadreurs assigned to the seed centers and the directors of those centers reported that it was a satisfactory manual.

The seed centers also were used as resource centers and demonstration farms. Each seed center was assigned 15 aide-encadreurs who were given the task of setting up demonstrations for farmers in the nearby villages. Some of the publications were used in training the Union Nigérienne de Crédit et Coopératives (UNCC) encadreurs. The cooperative and credit advisor assisted UNCC officials in recruiting and training new employees and the extension advisor presented a couple of sessions on extension work and activities.

The opportunity to explain the nature of the U.S. land-grant educational system and extension programs to the Nigerien Secretary of State for Rural Development presented itself during a trip to Rome to request multinational donor funds to expand and improve the agricultural school at Kolo. A proposal and arrangements for a visit to Texas and Arizona by the Nigerien chief of extension and head of research were made to the NCP coordinator. The trip would have permitted visits to the seed certification service at Austin, research facilities at Lubbock, and extension services and branch offices on an Indian reservation in Arizona, and would have acquainted the visitor with U.S. methodology and techniques in research and extension programs. The proposal was rejected by the GON coordinator, who would not approve expenditures of NCP funds for the visit.

Convinced that a place was necessary to receive, process, and disseminate information, as well as to provide a center for training, the extension advisor collaborated with the cooperative and credit advisor in preparing a paper titled Proposal for a Learning and Information Center in the Ministry of Rural Development for the UNCC and Agriculture Extension Services. The directors of the Service of Agriculture, UNCC, and INRAN accepted the idea. The projected five-year budget of AID, which was developed after the meeting to discuss the proposal, included $1.7 million to carry out the proposal.

Other ideas that were presented to the chief of extension included plans for a rural development committee, a suggestion to purchase French-Canadian extension bulletins, trips to the United States by GON officials to observe educational and agricultural programs, and a trip to Nigeria. The extension advisor and seed specialist made color slides of the farming procedures on the seed centers. Copies were made for each of the departmental agents and were distributed to them when projection equipment arrived in Niger. Cameras, tape recorders, and art supplies for making posters were ordered and were appropriately distributed.

The extension advisor also made arrangements for the chief of extension to visit the director of extension at Ahmadu Bello University at Zaria, Nigeria. There, he observed firsthand a reportedly successful extension program which was patterned after that in the United States. Several extension bulletins in English were obtained. The extension advisor explained the contents to the chief of extension; later they were translated into French and were typed for his library. The trip not only provided information to the chief of extension but also provided an opportunity for he and the extension advisor to get better acquainted and exchange ideas. The chief was encouraged to seek additional training in the United States and to schedule a visit to the United States or Canada.

The second evaluation team recommended that an analysis be made of the extension-type programs being conducted by the Ministry of Rural Development. The extension advisor, assisted by AID employees, carried out a rather comprehensive study of these activities. The report could well serve as a guide for future recommendations designed to improve extension work in Niger.

The study examined the following: Service of Agriculture, UNCC, CNCA (Caisse Nationale de Crédit Agricole), OPVN (Office des Produits Vivriers du Niger), Badeguichiri Productivity Project, Dosso Rural Development Project, Maradi Rural Development Project, Animation ("Continuing Education"), Alphabetisation ("Adult Literacy"), Niger Range and Livestock Project, INRAN, and IPDR. As a result, the extension advisor concluded that the combined efforts of these projects were achieving a reasonably acceptable level of extension activity relative to his knowledge of the system in the United States. After the completion of the study, recommendations were made to continue the Niger Cereals Project, support productivity projects in their extension efforts, and support the continued use of aide-encadreurs for farm demonstrations in villages near seed centers.

John Harvey assumed the position of extension advisor in January 1979 and continued the program until June 1980. During the five years of project work, the need for better training and better management of aide-encadreurs was stressed continually by the NCP extension advisors. This emphasis led to notable improvements in training during the final year of the project.

Three primary types of support for training in agricultural extension were provided by the NCP. They were in-service training of agricultural personnel, out-of-country training in the United States, and production of extension education and training materials.

In-service Training

All aide-encadreurs funded by the NCP received minimal in-service training during the five-year period from 1976 to 1980. Two to three weeks of training were provided at the time of employment and group training sessions of the same duration were held at the beginning of each year's cropping season. This training was organized and conducted by the agricultural staff at the departmental level. In some departments the NCP and productivity project aide-encadreurs were trained concurrently with the productivity project staff conducting most of the training. The NCP seed multiplication centers, Young Farmer Training Centers (CFJAs), and Centers for Rural Training (CPRs) were

used as training sites. The training included both classroom and practical field work.

During the project, the quality of in-service training gradually improved and in the final year considerable improvement was achieved. The efforts of Mohamed Abdoullaye, extension specialist, and other NCP staff members in planning and scheduling training programs were largely responsible for the improved training. During the month of February 1980, the departments at Maradi, Tahoua, and Zinder were visited; plans for the 1980 training program were discussed with the departmental chiefs of agriculture. Later, the NCP extension specialist and the coordinator arranged for the Kolo Agricultural School to conduct a four-week training program for 110 aide-encadreurs.

Altogether, three four-week training programs were conducted; all aide-encadreurs funded by NCP participated. The training emphasized the farm practices recommended for increasing agricultural production and the methods and techniques of conducting extension work at the village level. Some basic education also was included. Two of these training programs were held in the departments at Maradi and Zinder. A third program was conducted at the Kolo Agricultural School for 110 aide-encadreurs from the Dosso, Niamey, and Tahoua departments. The Kolo agricultural staff was in charge of the training but NCP Coordinator Salifou Mahamane and Extension Specialist Abdoullaye served as members of the training staff.

Because of Kolo's well-trained instructional staff and its adequate training facilities, the training program was superior to those conducted during previous years at other locations. In the future, consideration should be given to utilizing the Kolo Agricultural School for conducting at least one three- to four-week training program each year for all aide-encadreurs.

In its 1979 budget, the NCP included $25,000 U.S. (5 million CFA) to finance the National Conference on Agricultural Extension. This conference was held in Tahoua from 1-6 March 1980. About 60 people from the Service of Agriculture and other government agencies and organizations participated. The conference provided the first opportunity for personnel from different agencies -- whose programs and resources need to be closely coordinated to

serve the farm population -- to focus on the specific theme of agricultural extension. Therefore, the significant role of agricultural extension in increasing agricultural production was emphasized. The fact that the Minister for Rural Development presided at the entire conference indicates how importantly it was viewed.

The NCP staff planned the basic program and made arrangements for holding the meetings in Tahoua. Objectives of the conference were to: (1) review and evaluate existing extension programs and methods; (2) consider new approaches for solving problems encountered by extension field agents; (3) establish a single coordinated program of agricultural extension capable of serving the farm population; and (4) understand and integrate all programs that support agricultural and rural development.

The program consisted primarily of reports by the department chiefs of agriculture, directors of the productivity projects, and directors of the government agencies and services of INRAN, UNCC, IPDR, Kolo, Animation ("Continuing Education"), Alphabetisation ("Adult Literacy"), and Information. The reports were followed by discussions focusing on problems and constraints relative to the implementation and improvement of programs. The effectiveness of these presentations would have been enhanced had the ensuing discussions been guided to establish definitive, unified actions required to improve the system for transferring agricultural technology and ensure its adoption by the farm population.

The knowledge and experience gained by the NCP personnel who planned and staged the conference will be useful in connection with similar activities in the future. The Tahoua conference was a beginning for the process of reviewing, assessing, and strengthening agricultural extension work in Niger. This should be a continuing process. All subsequent activities can build upon and benefit from the Tahoua conference.

Out-of-Country Training in the United States

Since the NCP began in 1976, only four Nigeriens have been sent to the United States for long-term academic training in extension education. Mohamed

Abdoullaye completed the bachelor of science degree in extension education at the University of Missouri and returned to Niger in January 1980. Three others pursued degree programs in extension in the United States -- one for the bachelor of science degree at the University of Missouri and two for the master of science degree at Michigan State University. These participants were scheduled to complete their degree programs and return to Niger in 1982 and 1983, respectively.

A limited number of Nigeriens were sent to the United States by the NCP for long-term academic training in subject areas other than extension: agronomy, 2; soil science, 1; seed technology, 2; plant breeding, 2; statistics, 1; and agricultural economics, 3. Some of these participants were still in training in 1980. In addition, some short-term non-academic training was provided.

On returning to Niger, Mohamed Abdoullaye was attached to the NCP as extension specialist. In this role he provided effective leadership in strengthening the agricultural extension program, especially in training personnel. His work with the NCP could have had a significant impact on the future development of agricultural extension, but unfortunately for that program, he was designated chief of the Niamey Department of Agriculture at the conclusion of Phase I of the NCP.

To date, Niger's agricultural extension program has benefited very little from out-of-country education because of the small number of personnel trained and the time required to complete such training. The shortage of manpower in the various subject areas and skills needed for the successful dissemination of agricultural technology remains the principal constraint on the development of an effective extension system.

In retrospect, the NCP training program has been inadequate in terms of educating the manpower required for a more efficient and effective agricultural extension service. This suggests that a much larger portion of project funds should have been allocated for training personnel, not only in extension but also in other activities. Some of the difficulties in developing a training program in extension were mentioned earlier. Additionally, it should be noted that delays in getting satisfactory candidates nominated for

the program also contributed to the lack of progress. Generally speaking, we were advised that one of the difficulties in this regard was identifying and finding people to go abroad for training.

Projects such as the NCP cannot achieve long-term goals and objectives without properly trained host-country personnel to assume continuing responsibility for the program after expatriate personnel have departed. Project funds cannot be used for a better purpose than for education. Commodities such as cars, tractors, and so on last only a few years, whereas a well-trained participant can last a lifetime.

Teaching Aids and Educational Materials

As there was a dearth of existing subject matter relevant to the various aspects of agricultural extension, the NCP attempted to improve the situation. Production of information on a wide variety of topics was begun early by the first members of the technical assistance team and was continued throughout the project. Primarily, source materials of two types were produced in mimeographed form: (1) those of a technical nature on topics relating to the production of cereals, both as food crops and for improved seed, and (2) those relating to the organization and methodology of implementing agricultural extension. Source materials produced by the NCP were supplemented by the acquisition from AID/Washington of a large supply of U.S. extension bulletins translated into French.

Some source materials were prepared for use in training courses for specific groups of personnel while others were prepared to provide general background information. The materials were designed for general distribution either to specific groups or to all agricultural and extension personnel. However, distribution of these materials was not always achieved and much of the information never reached the field staff. Some of the materials were viewed as inappropriate for the field staff because they were patterned after the U.S. systems of extension and were not considered applicable to conditions in Niger. All materials were translated into French, and in some cases the translations may have been poor.

During the NCP operation, the NCP technicians were required to accept Nigerien methodologies and techniques in extension as well as other project programs. The reluctance of GON officials to accept certain ideas and suggestions thwarted the testing of new approaches for strengthening the agricultural extension system. Nigerien agricultural officials tended to consider programs from other countries as unapplicable to conditions in Niger, without trying to identify basic principles of these programs which may be useful.

A considerable amount of audio-visual equipment and educational material was purchased by the NCP for use by agricultural extension personnel to improve their teaching. This included projectors and screens, cameras and recorders, and materials and supplies for making charts, posters, and other visual aids. These commodities were received in Niger in 1977 but remained in the project warehouse -- perhaps justifiably, because of the lack of an accepted program for their use -- until mid-1979 when distribution was started.

The chef de vulgarisation approved the NCP's plan for distributing this equipment to obtain maximum use in personnel training and extension work with farm groups. Equipment and materials were organized into 10 sets and distributed as follows: one set to each department office of the Service of Agriculture except Agadez, one set to the NCP coordinator's office, and two sets to the Training Office of the UNCC.

Each set of equipment contained a carrousel slide projector and projection screen, a cassette recorder, a camera and film for making color slides, two portable easels with chalk boards and newsprint pads, and equipment and materials for constructing lecture and visual-aid displays. Portable gasoline-powered generators were placed in the departments at Diffa, Maradi, Tahoua, and Zinder so that the audio-visual equipment could be used in villages without electrical power. The placement of these teaching aids and educational materials in the department offices made them accessible to the field staff for use in extension teaching and other activities.

At the time of delivery, the ways to use the equipment and materials were demonstrated to the chief of the Service of Agriculture and members of his staff. The basic instructions were sufficient to permit the chiefs to operate the equipment properly. However, training and practice should be continued in order for extension personnel to develop skill in using audio-visual aids effectively in different teaching situations and for different purposes.

In addition to the direct forms of support previously discussed, the Niger Cereals Project contributed to the agricultural extension programs in other ways. Personnel of the Service of Agriculture who also conducted extension work received commodities such as vehicles, office equipment, farm machinery, and equipment useful in implementing extension activities. The five regional seed multiplication centers were utilized by extension agents to conduct farmer-education programs which included demonstrations, field days, and so on. The research program supported by the NCP produced recommendations for the production of cereals and other crops which form the basis of the agricultural extension program.

COOPERATIVE AND CREDIT ADVISOR

Plan of Work: The plan of work developed by the cooperative and credit advisor, Cao Quan, encompassed the work of the Union Nigérienne de Crédit et Coopératives (UNCC). The GON had decreed that the UNCC was the mechanism for managing village-level demonstrations and providing inputs and services to improve farming. It was also to act as the market channel from farm gate to first processor. The CID advisor proposed plans to improve organization of cooperatives, establish personnel training centers, provide training seminars, and assist in agricultural extension programs at the farmer level.

The establishment and growth of cooperatives, the training of UNCC encadreurs ("field agents"), the establishment of department training centers, and the training of cooperative officers were all achieved during the term of work of the cooperative and credit advisor. Legislation establishing the legal status of the cooperatives was obtained. Improved efficiency in procurement

and distribution of farm products was achieved through the organization of a center for supply and distribution.

The UNCC had been given the responsibility for integration of a number of rural development projects such as the 3-M Project in Zinder Department, the Maradi Rural Development Project and the Dosso Productivity Project. It was a strong, well-organized, and semi-autonomous governmental agency. It had heavy extension activities as well as responsibility for supplying agricultural and financial inputs.

The UNCC Division of Supply was responsible for the collection of information on farm material input needs. In conjunction with Caisse Nationale de Crédit Agricole (CNCA), the UNCC advanced funds to farmers to purchase equipment, seed, fertilizer and insecticides for agricultural production. Loans were repaid to UNCC mutuals which also made governmental purchases of agricultural commodities from farmers at the village levels.

Distribution of imported supplies was made through UNCC distribution centers. A well-developed training program provided persons trained in accounting, budget regulations, and inventory procedures. Agricultural training was given to 80 aide-encadreurs to provide field agents each year.

The primary weakness of the agency was the tardiness in determining important requirements and bureaucratic delays in distribution of commodities and funds.

In the four-year period that the cooperative and credit advisor worked with the UNCC, many of the objectives set forth in the project agreement were achieved:

1. Training of 160 aide-encadreurs ("field agents") as planned was accomplished.

2. As a result of the above training program, the UNCC was able to organize an additional 233 cooperatives, concentrated mainly in the cereals projection departments.

3. Through activities of the Dosso Productivity Project, farmers were convinced of the benefits of using better agricultural practices such as improved cultivars of seed and the application of fertilizers and insecticides. This was accomplished by organizing farmers into production groups which facilitated distribution of credit and agricultural materials and information. Also, a number of "farmer demonstrators" were trained to advise other farmers interested in adopting new techniques. Obviously, the real motivating factor in changing agricultural practices was to demonstrate ways of obtaining an increased yield.

4. In-service training of field agents helped keep those individuals up-to-date regarding new techniques and activities being promoted by the organization and helped improve communication between the national and local personnel.

5. The Farmer-Training Program achieved significant progress during the four-year period. The establishment of 20 permanent cooperative training centers in Dosso and four in Diffa met with relative success. The training program was designed to teach leaders and members of the cooperatives how to read and write in their native language, how to improve management of a cooperative, and how to utilize simple agricultural techniques. The goal of cooperative self-management is well on the way to being realized through this training program.

6. The organization of a Center for Supply and Distribution of Farm Inputs, for farm information and materials within the UNCC, was the first step in facilitating availability of commodities to farmers. Consequently, as a direct result of having and using these, yields should increase and Niger should come closer to realizing its goal of food sufficiency.

7. The legal status of the cooperative organizations and the Decree of Implementation were proclaimed by the government on 12 October 1978 and 18 January 1979, respectively. The new cooperative law authorized an autonomous status for the cooperative movement in Niger. Cooperative

members will be reorganized into a new structure with the different levels of activity in the village mutual being represented in the National Cooperative Union. These representatives will also participate in a new "Societe de Development" that the government envisions in the future.

AGRICULTURAL ECONOMIST

Achievements of the Niger Cereals Project in the field of agricultural economics are not directly comparable to achievements in agronomic research, seed multiplication, or extension because of the deferral of any emphasis on and the limited total input into the program of economics. No work was done on Nigerien agro-economics until approximately one year before the end of Phase I, when five months of consultation time were allocated to problem definition, program description, implementation, and reporting. Despite these limitations, progress was achieved.

In total, four reports -- which can be considered achievements of the agricultural economics component of the project -- were prepared. These four reports were: (1) a recommended agricultural economics program for the project; (2) a survey of economics of cereals production; (3) a survey of economics of the Seed Multiplication Program; and (4) a brief paper presenting the consultant's view of Niger's needs for increasing food production.

Recommended Agricultural Economics Program

The first of these papers reviewed the intentions and commitments of the project relative to economics, as revealed by project documents and evaluation reports, and designed a program to achieve as many of the objectives as possible. Use of a consultant was recommended to avoid the inevitable delays in obtaining a regular team member. Six months of consultation time appeared to be sufficient to carry out studies of cereals economics and the Seed Multiplication Program, and to collate and analyze socioeconomic data on rural households gathered by a three-year funded survey by AID. The

recommendations of this report were accepted and implemented except that the time was reduced to three months and the analysis of data was deleted.

Economics of Cereal Production

The study of cereal economics indicated that the average farm family -- one of average size, on a farm of average area with typical crops producing average yields -- is more than self-sufficient in cereals and realizes a labor income roughly equal to the existing rate for wage labor. The technological innovations which are available to farmers, or have been proposed for their use, produce benefits that may be greater or less than their cost. The most profitable innovations, based on a farmer's costs and on yield-increasing effects of the innovations as revealed by published research results, are line seeding and the use of fertilizer on millet and sorghum. However, new cultivars of cowpeas, use of phosphate and nitrogen fertilizer on cowpeas, and incremental weed control efforts do not appear to yield benefits that are worth the costs. Because the study relied on crop response data from research trials rather than on results of the farmers' yields, the unexpected lack of profitability of weed control and phosphate fertilization of cowpeas is subject to some question. But at least the study provides quantification, whereas previously only intuition and agronomic generalizations were available.

Economics of the Seed Multiplication Program

The study of the Seed Multiplication Program developed estimates of the cost of producing high quality third generation (M_3) seed of improved cultivars of millet and cowpeas, as well as estimates of the benefits to the farmer from using such seed. Based on the system of producing M_1 seed by the foundation seed farm, M_2 seed by the seed multiplication centers, and M_3 seed by growers under contract, the cost of the program prorated over an output level of 1200 tons of M_3 seed produced would be 269 CFA per kilogram of M_3 seeds. If the program was expanded to achieve a production target of supplying new seed for one-fourth of the nation's crop area each year, the cost could be reduced to as low as 168 CFA per kilogram. Benefits of improved seed accrue from several facts:

1. The variety has been tested by research and found to have superiority in one or more characteristics, i.e., disease or insect resistance, growth type, or quality characteristics and ultimately higher yield.

2. Improved seed implies varietal purity which assures the purchase of high quality seed uncontaminated with low yielding varieties, weeds, and inert matter.

3. Improved seed has high viability assuring good germination in the field, and uniform large grains to produce vigorous seedling growth that allows reduction of seeding rates.

Benefits and savings from using such seed could be as much as 2055 CFA per kilogram of millet seeds and 471 CFA ($1.35 U.S.) per kilogram of cowpea seeds.[7] Prices paid by the farmers for such seed should return as much of the program's expense as possible, while giving the farmer a good to excellent profit on his investment in new seed. Prices recommended by the study were 150 to 250 CFA ($.75 to 1.25 U.S.) per kilogram for millet and 175 to 250 CFA ($.87 to 1.25 U.S.) for cowpeas. Selling seed at these prices would not generate enough income initially to pay the costs of the program, so some subsidization from the government or other sources would be needed to maintain the scope of the program until it could be self-sustaining.

The seed multiplication study originally was intended to use FSF and SMC records of production costs. However, incomplete files or recent implementation of the activities resulted in the unavailability of many of the needed records, so budgeted data had to be used instead. By the use of available data from the FSF and SMCs and data accumulated for the Economics of Crop Production report, it was shown that the cost of quality seed could be reduced to 168 CFA per kilogram. The conclusion of the study that quality seed could eventually be produced at a price the farmer could afford supports the intuitive conclusions of those who conceived, designed and implemented the Seed Multiplication Program. In addition, it sharpens the focus for future planning and development of the program and provides guidelines for decisions about seed prices and program subsidies.

Niger's Needs for Increasing Food Production

The paper on increasing food production was completed after the consultant returned to the United States because the time in Niger was insufficient to do so. This paper discussed certain agricultural problems in Niger and recommended research, action programs, and institutional changes to overcome them.

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Problems

The Niger Cereals Project was developed as a result of the severe drought that occurred throughout the Sahelian countries in the early 1970s. An American team of experts began the project design in April 1974 just at a time of political upheaval in Niger. The guidelines for the project were developed and covered in the Program Agreement dated 17 September 1975. At this time AID requested proposals from interested institutions for conducting the project. Early in 1976, prior to the selection of the project contractor, a team -- consisting of John Oglethorpe, Herbert Mann and Cao Quan -- was requested to implement the project. Project commodities and some equipment were ordered, seed center sites selected, and some experiments designed and left in the hands of the AID staff technicians.

The Consortium for International Development was awarded the contract and asked to field a team in September 1976. None of the universities or team members had been involved in the formulation of the project except Cao Quan, who had served as a consultant in 1976. Each team member was asked to develop a plan of work by which his assignment would be accomplished. With its approval the team member expected to be able to perform his functions with the professional independence and proficiency of his training.

The Niger government insisted that each team member be assigned to a government service to be administered by the chief of that service. CID desired the members to function as an interdisciplinary team with the needed coordination efforts of a chief of party. AID project managers were reluctant, or unable, to direct the Nigerien project coordinator in budgeting or adminis-

trative matters. Thus, the CID technicians were frustrated by the divisive actions of three administrative units: GON, CID, and AID.

Among the many problems which plague Niger's agricultural development, and particularly its agricultural extension program, is the lack of personnel trained in modern methods and techniques. A shortage of skilled professional manpower in the modern subject disciplines and skills is the principal constraint on the development of an effective system.

Numerous examples exist of the inability of countries to achieve long-term goals without trained domestic personnel to assume responsibilities and move forward toward established goals after the departure of expatriate personnel. For whatever reasons, Niger has not succeeded in training even the bare minimum of individuals needed to provide leadership and guidance in the effort to establish greater self-sufficiency in agriculture. Materials and equipment provide a good showcase but they are ephemeral in the long run. The figurative handful of skilled professionals, regardless of their ability and brilliance, will be unable to accomplish the task. The most precious commodity Niger could develop would be a substantial cadre of domestics trained in the full spectrum of agricultural disciplines -- individuals capable of disseminating modern agricultural knowledge and techniques adaptable to the Nigerien environment and culture. At the same time, the acceptance of a philosophically open-minded attitude toward new procedures and techniques by the governmental bureaucracy is essential. No better purpose could be served in assisting countries than the provision of funds to design, implement, and fulfill a well-designed program of education. We would assign such an educational program the very highest priority for the next decade and would offer the counsel that many of the individuals should be trained in diverse arid regions of the world. The infrastructure, in the broadest sense, for agricultural development will not come easily nor quickly and much time has already been lost.

Agricultural problems analogous to those of Niger have been tackled and at least partially overcome in other parts of the arid world. Those approaches may not be transferable or applicable per se to Nigerien conditions but certain principles will be. The identification of those principles and the

open-mindedness to try them is critical to the solution of Niger's problems. This will involve a willingness on the part of certain government officials who, throughout our experiences, thwarted the testing of new approaches based on an attitude that programs and approaches from other countries were not applicable to Niger. As a matter of fact, the farmers themselves appeared far more willing to consider new approaches than some -- but certainly not all -- members of the governmental hierarchy.

The administrative arrangement of the project unfortunately provided for a triumvirate in which AID, the GON, and CID/Texas Tech University shared responsibilities, with no one member in charge. Because of the split responsibility, the arrangement was not conducive to maximal achievements of the project. We realize full well that the GON was the host country and certainly should have been involved in consultations regarding the program. At the same time, AID was providing the funds and the donor should have had certain rights and prerogatives to ensure that such funds were not squandered or diverted from the purposes of the project. Equally important is the fact that agricultural experts were imported, only to be thwarted at many turns from carrying out designed programs and from implementing non-Nigerien approaches to problems. We ask, of what value are funds constricted in such a manner?

In instances, experts willing to travel to Niger for consultation on specific problems were denied visas by parties unknown, based on the allegation that such consultation was not really necessary, when to the members of the project the need was quite obvious. We do not know whether the denials were from AID or the GON.

We suggest that one possible solution to these sorts of problems would be for AID to grant support funds with the strict qualification that the "contractor" -- once selected -- have full responsibility for administration of an agreed-upon program or project in its entirety. If proper cooperation and support were not forthcoming from the host country, the tough decision to terminate the program and withdraw funds and personnel should be made.

Substantive segments of any failures on the part of the CID team may be ascribed to the fact that they were not given the responsibility and the authority to proceed to accomplish the project as established. In different words, poor managerial arrangements and practices by both AID and the GON contributed substantially to the inability to achieve certain goals.

Each of the CID team members felt significant progress had been made in meeting the objectives detailed in his plan of work. We also recognized there could have been greater success. The failures occurred as the result of problems faced by each of the team members.

ADMINISTRATION AND RESPONSIBILITY FOR ACTIVITIES

The series of annual evaluation conferences helped identify some problems but were unsuccessful in eliminating many of them. Early in the program, administration and responsibility for the Niger Cereals Project was not clearly defined. Salifou Mahamane (8) pointed out the existence of dissension in the GON. John Fischer (9) noted in the report of the second evaluation a misconception between GON and CID regarding the administrative function of the team leader. A lack of understanding between CID and AID on how the "team" was to function was discussed by Anson Bertrand (10) and Richard Vengroff (11).

Jay Johnson noted that the project was activated a year prior to the arrival of the CID team (12). Frank LeBeau (13) pointed out that the project was launched long before the CID team arrived and that "in fact the GON services themselves were not entirely organized to manage the project during the first year."

Dan Aronson (14) discussed "gaps between Pro-Ag agreements signed by both governments and the implementation that has ensued." Whereas his remarks were addressed to the extension program, similar "gaps" occurred in the seed program -- for example, the failure to obtain a seed policy statement. Daaloul (15) noted the fallacy of trying to develop a seed program without a well-defined policy statement. Ferguson (16) suggested the mission should

review the need and usefulness of the seed program in Phase II if progress on legislation was not accomplished by mid-1980.

FRENCH LANGUAGE FLUENCY

Alex Cunard and Cao Quan were the only CID members fluent in French. Other members had varying degrees of French fluency, and generally were handicapped in communicating with personnel in the services to which they were assigned. Individuals vary greatly in their ability to learn a language, and consequently, the general expectation that people can learn French in a six-week orientation course is overly optimistic. Formally scheduled French classes should be mandatory for all technicians at post. If scheduled classes are not mandatory, the technician will commonly become so involved in his work that he will slight language training.

A valid argument can be made that the basic objective of any project such as the NCP is the transfer of expertise and the training of personnel. Obviously, fluency in the local language is highly desirable and advantageous. In the case of the NCP, much emphasis was placed on the lack of French fluency by certain team members. Yet worldwide, many projects have been implemented and successfully completed with the use of translators. The impression is clear to the members of the NCP team that too much emphasis and time were given to criticizing the language inabilities of some of the personnel and not enough emphasis and time devoted to efforts to obtain and utilize the expertise of the technicians through any and all means. The cost of the time and expertise lost in the exercise could easily have paid for ample translators to handle the major problems.

All team members made a sincere effort to improve their abilities in French during the assignment in Niger. The use of translators, interpreters and English-speaking Nigeriens helped minimize the language constraint, but even so, it was cited often as an excuse for program failures. If deeper studies were made, reasons other than language would likely be found to be the cause.

MAJOR PROBLEMS OF TEAM MEMBERS

Each team member recorded the major problems enccuntered in his specific project area.

Agricultural Engineer

Problems for the agricultural engineer concerned obtaining laborers, equipment, and transportation for research work. Lack of project administrative capability hindered disbursement of funds for essential needs. Payment of wages to laborers was often delayed for months.

The constant demand for time on non-project-related jobs led to confusion in objectives and responsibilities. The project job description did not accurately explain the situation. It was felt a more coordinated effort between AID and CID would have been helpful.

Plant Breeder

The single most significant problem related to the plant breeding program was the failure to appoint a Nigerien sorghum breeding counterpart whose function would have been the continuation of that program. Upon returning to Niger from training in the United States, the individual educated for that role was assigned to other duties in the country.

Nigerien plant breeders questioned the advisability of making crosses using parent varieties whose climatic adaptability had not been determined. They resisted recognition of the evaluations of the international research centers and acceptance of the idea of combining good germplasm and possibly producing superior offspring. Thus, many of the bulk populations created by the crossing program were not produced in succeeding years.

Problems of administration were a constant frustration. Clark Harvey commented in his first annual report:

It was my understanding when I accepted this position that I would be free to move within and outside the country with only the constraints of professional and civil responsibilities and approval within the CID structure. I was to inform my counterparts of my movements, but such movements were not to be under the authority of any GON officials. I was denied a trip to Samaru, Nigeria, to visit with professional colleagues and review research work being conducted at the station because I was told that I had to get approval from INRAN officials. I have been told that even my vacation plans must have such approval.

It was my opinion that CID, as a component, had a budget and the use of funds would be controlled by the CID organization. CID had a budget for official travel of personnel. Some such travel was disapproved by an AID official. CID had a budget to cover further training in foreign language. Authority to use such funds to attend a short course in French language training was approved by the CID coordinator but was denied by an AID official.

These points are not to be construed as a desire to lessen any authority but are raised so that I, as a member of the CID team, can be properly informed of the areas of authority.

Lack of authority and control of the budget also resulted in other problems. Many commodities that were requested arrived late and some were never delivered. A procedure for requisitioning supplies and materials for CID project activities was never established.

Agronomist

The primary factor contributing to the lack of success by the agronomist was the length of time involved in obtaining appropriate equipment -- a combined result of delays in ordering and the length of time required to process the orders and receive them. For example, a list of 12 items of equipment

extracted by Lamborn[10] from the Plant and Physiology Laboratory list was requested in the 1979 work plan. Subsequent efforts and inquiries ended in frustration and failure to obtain the items.

A certain level of equipment is necessary in order to maintain or to increase the efficiency of a researcher. No agronomist should go into the Sahel for work without at least a pH meter, a drying oven, and a micro-Kjeldahl nitrogen apparatus, in addition to other basic equipment. These should remain under the researcher's supervision until someone has been trained properly to utilize them. Such equipment, which should be paid for by the project, should serve to assist the scientist in achieving better results. The present arrangement, under which the project has paid the bill for thousands of dollars' worth of equipment, is perfectly valid. Unfortunately, the technical staff of the NCP has not been able to use many of the items of equipment, either because they were still in storehouses in Niamey, because there were no laboratory facilities ready for their installation, or because there were no technicians who had been trained to operate them.

Although the agreement among AID, CID, and GON stated in the contract that the "agronomist will work with a Nigerien counterpart" there were no agronomy-trained Nigeriens available as counterparts in the period from 1976 to 1979. In early 1980, a returning trainee was immediately assigned to work as assistant to the director general of INRAN and was not available to the research program.

The agronomists, as well as other members of the research team, were expected to have their plans of work approved by AID through the research team leader and the chief of party; at the same time, the work plans had to satisfy the GON through the director of the Centre National de Recherche Agronomique, the director general of INRAN, and at times, the director of the Service of Agriculture and the minister of Rural Development. The objectives and intentions of GON often were not the same as those of AID. For example, the

[10]Lamborn, R.E., 1979, Final report consultant mission to Niamey, Niger, 29 November to 13 December 1978. CID.

AID contract did not include any arrangements for teaching apprentices for the entire INRAN organization because such responsibility reduced research time, but GON insisted that this was a basic part of our assignment. As the problem was never resolved, the agronomist had to conduct a teaching program as well as carry on the research necessary for the project.

Whenever a researcher needed to make a field trip or a telephone call which he judged necessary, permission had to be obtained from the Nigerien CNRA chief. Often, such permission was difficult to acquire. The telephone problem was resolved by placing a line in one of the residences.

The activities of each member of the research team contributed much to Nigerien agriculture.* However, little use appeared to be made of these contributions and it seemed that our findings made little impact on agricultural practices in the country. Admittedly, agronomic research data, even in most developed countries, are not put into general practice as soon as they are available. It takes time. In Niger, however, there is dire need for a policy to ensure that good research findings are extended to the farmer.

The present system is that researchers make reports at an annual meeting of the Ministry of Agriculture and Rural Development. In addition, the scientist may or may not also present recommendations, which are mimeographed in Themes Proposes a la Vulgarisation pour la Campagne. Commonly, there was not a sufficient number of these copies to provide one copy to each member of the extension staff. The copies were written in French, but most farmers speak a native language, and the papers were largely too technical for the average farmer's use. In 1977 the agronomist cooperated in the presentation of Themes but no involvement occurred in 1978 and 1979. This system of interaction among the researcher, the extension officer, and the farmer should be improved because it was the weakest link in our chain. However, future improvement in this regard is anticipated as a result of methods introduced by CID extension specialists.

*See annual reports of the plant breeder, the engineer, and the agronomist.

Special note is made here that one of the major problems with agricultural extension in Niger is dual control of such activities between INRAN and the Service of Agriculture. Each organization has its own ideas of how the programs should operate and each has partial control over the budget.

Seed Specialist

The Seed Multiplication Program did not achieve the level of operation and production visualized at the onset of the project.

The irrigation system on the FSF was not completed. This did not prevent production of sufficient M-1 seed to supply the SMCs. More damaging to the program, however, was the inability of INRAN to provide sufficiently pure M-0 seed of millet and sorghum cultivars to permit multiplication of high quality seed. The practice of INRAN to produce large quantities of so-called "basic" seed prevented the development and utilization of the precise techniques required for maintaining pure varietal characteristics. This is a difficult achievement with cross-pollinated crops such as millet which requires varietal isolation and specialized multiplication blocks to retain plant vigor. It cannot be done on a large-scale operation.

Production on the SMCs did not reach anticipated levels but the yields were more than sufficient to supply the amounts of M-2 seed requested by the productivity projects and needed by departments for M-3 seed production. Attempts to cultivate 60 hectares with eight pairs of oxen proved extremely difficult. The oxen were untrained and the workers were inexperienced in handling animals.

The level of cooperation with department productivity projects for production of M-3 seed by contract seed growers was limited. The Dosso Productivity Project had a small hectarage in 1978 and the 3-M Zinder Project cooperated in the 1979 and 1980 programs. A lack of strong leadership and proper planning sessions among the national services and the projects contributed to the lack of cooperation, and the SMCs ended up with the responsibility of attempting to increase the quantity of M-3 seed through the use of contract-seed growers.

Attempts to acquire even limited amounts of M-3 seed were difficult. Efforts to finance the purchase through national channels at the village level were futile. Funds were not available at the proper time and the proffered prices were too low to compete with local market prices.

Demand for M-3 seed by local farmers was almost nil. Very little extension activity was conducted to demonstrate the value of improved cultivars and high quality seed. Tours for farmers to SMCs, departmental demonstration plots, and contract M-3 seed plots have just begun to interest the Nigerien farmers in improved seed.

Slowness in the construction of buildings prevented installations of seed processing equipment and a consequent delay, until 1980, in the availability of facilities for the training of personnel in the operation and maintenance of the equipment. Accordingly, the period of training was insufficient. Additionally, failure to assign experienced mechanics to the seed centers resulted in situations where inexperienced chiefs of center and laboratory technicians were left with the responsibility for complex equipment but without personnel trained sufficiently to maintain and repair it.

Although a seed policy statement with guidelines for development of the Seed Multiplication Program was prepared early in the project, repeated efforts to have it officially accepted or adopted were unsuccessful.

The failure to gain acceptance of a seed policy statement and the lack of a functional national seed board or committee prevented the establishment of a fully coordinated program among the many agencies required for a successful seed program. The organization and agencies are operational at the national and departmental levels, but lack the guidelines and coordinated structure to function as a unit.

Productivity projects have seed multiplication programs not associated with the national program. INRAN supplies basic seed to other programs, reducing the effectiveness of a national program. The departmental Services of Agriculture are attempting to develop extension and demonstration personnel who can duplicate efforts of the productivity project. The financial facilities

of UNCC to provide credit for seed and other agricultural inputs are not being utilized in the national seed program. These activities could be coordinated and structured by the National Seed Coordination Committee if a seed policy statement with guidelines and regulations was adopted.

The failures were brought about by a number of problems. A lack of strong administrative procedures was primarily responsible. The seed specialist assigned to the Service of Agriculture could only propose action to be taken by the chief of the Extension and Seed Production divisions. These proposals were not acted upon or were delayed for long periods of time because of other activities of the chief. Proposals made to the Nigerien project coordinator or to the AID project manager were referred to the Service of Agriculture, which suggested that such action was a function of NCP and not the responsibility of the services.

Responsibility for action was assigned, but authority for execution was withheld. When corrective action was necessary at the seed multiplication centers, directives had to come from the Service of Agriculture through the department to the chief of the center. Programs elaborated in the office by national administrators early in the year could not be altered or adjusted during the growing season. A lack of competent personnel and a lack of confidence and trust in subordinates by national leaders were undoubtedly the causes of such restrictions. These fears were justified in two cases where chiefs of centers were found guilty of embezzlement of center funds.

Production in the SMCs was limited by poor cultural techniques and practices. Daaloul[11] expressed concern on the dual goal of the SMCs for seed multiplication and as demonstration farms. Lack of SMC administration in labor management of program planning and lack of individual initiative were definite constraints. Insufficient and sometimes confusing national directives did not provide adequate leadership.

[11]Daaloul, A., 1978, Report on the second evaluation of the Niger Cereals Project, p. 67.

An insufficient number of people were made available for training at all levels. Only two trainees were given administrative and technical training in seed technology. Three persons were allowed to attend the seed technology three-week short course and three were given a field trip to observe seed programs in Morocco and Tunisia. The loss or transfer of any one man from this group left a gaping hole when the four processing plants were in operation.

The failure to assign even graduates from the Institute Pratique de Développement Rural (IPDR) at Kolo as mechanics to the SMCs left the centers with electrical generators, vehicles, and motors but no adequate maintenance service.

The lack of counterparts left the CID team members with a feeling of only filling a professional position that could be filled by a local or expatriate technician. Our desire was to work closely with a GON countryman so that at the termination of our contract we could feel we were leaving the program with ongoing possibilities.

Extension Advisor

Programs in all countries encounter constraints in their operation. Major constraints of the extension advisor fell into two categories: (1) those inherent to the organization and the program of agricultural extension, and (2) those related to fulfilling the role of extension advisor. These constraints influenced the implementation of extension programs for the purpose of disseminating new production technology and getting it adopted by the farm operation.

Organization and Program Constraints

Geographical Characteristics of Niger. -- Niger is a large and sparsely populated country. The great distances that must be traveled to reach administrative centers and rural villages take much time and make communication and transportation very costly. The lack of an adequate infrastructure adds to the problems involved in implementing rural progress.

Approximately two-thirds of the country is arid desert generally unsuitable for agriculture. In the remaining one-third, agricultural production is unreliable because much of the land is of marginal quality and normal rainfall is minimal. The large rural segment of the population practices a typical peasant lifestyle oriented to subsistence farming.

Whereas little can be done to change the geography of the country, some of the physical conditions and features constitute major constraints on socio-economic development.

Ethnicity of the Rural Population. -- The rural population is composed of several ethnic groups; some are sedentary and some are nomadic. The sedentary groups, which represent approximately three-quarters of the population, include the Hausa, the Djerma, and the Kanouri. The nomadic population, constituting approximately one-quarter of the population, consists of the Fulani, the Touareg (Tuareg), and the Toubou ethnic groups. Some of the Fulani are sedentary whereas others are nomadic.

Because of the different traditions, lifestyles, and languages of these ethnic groups, rural programs such as agricultural extension need to be planned specifically to meet the particular needs of each group. The provision of effective programs for the different ethnic groups requires a level of resources that is not presently available to the GON.

Level of Literacy of the Rural Population. -- Approximately 95 percent of the rural adult population is illiterate. Therefore, communication and the adoption of new agricultural technology and farm practices are hampered. Since the majority of adult farmers cannot read or write, individual methods are required for the effective communication of new ideas and practices. This requires a high ratio of extension agents to farmers and adds to program costs. It has been well established through research that the first farmers to adopt agricultural innovations have a higher level of literacy than those farmers who are slower to adapt.

Number of Qualified Extension Personnel. -- The shortage of adequately qualified personnel is a major constraint on planning and implementing a success-

ful extension program for increasing agricultural production. Even though a significant number of para-professional personnel were employed to work as extension field agents, substantially increased numbers of more highly skilled personnel are needed. At present, the relatively small number of personnel trained in the agricultural sciences are fully occupied with administrative chores. There is an almost complete lack of personnel who possess the skills required for the successful transfer of agricultural technology to the farm population. For the successful implementation of agricultural extension programs, increased numbers of personnel will be required for the essential roles in agriculture, agricultural education and extension, rural sociology, agricultural journalism and communications, agricultural economics and farm management, administration, and supervision.

Organization of Agricultural Extension. -- Agricultural extension in Niger is administered by the Service of Agriculture in the Ministry of Rural Development. Extension, however, is not organized as a separate function with its own personnel. Individuals at all levels in the Service of Agriculture are responsible for the overall agricultural program, including the extension function which has been limited in scope primarily to crop production.

The agricultural extension function is sufficiently important to require its own staff and organizational structure if it is to provide program leadership and support services. The lack of a unified extension service is a definite constraint on the implementation of an extension program capable of having a significant impact on increasing agricultural production.

Lack of National Programmatic Coordination. -- Several government agencies and services conduct extension-type programs to benefit rural people and provide research information and resources useful to rural activities. These agencies and services include Animation ("Continuing Education"), Alphabetisation ("Adult Literacy"), INRAN, UNCC, and special productivity projects. All have similar purposes and objectives. The lack of coordination among their programs and resources reduces the opportunity for making the maximal impact on agricultural production.

Constraints on Fulfilling the Role of Extension Advisor

Organization of the NCP. -- Administration of the NCP was divided among the GON Service of Agriculture, AID, and CID contract personnel without any real lines of responsibility and authority. Day-to-day operations were the responsibility of the project coordinator of the Ministry of Rural Development, the AID project manager, and the CID chief of party; each of these officials was responsible to the parent organization.

Each project component operated from separate offices with separate staffs. Additionally, under the project structure, each member of the CID group was responsible to an autonomous GON organization: INRAN, UNCC, or the Service of Agriculture. Therefore, in actuality, CID personnel related to at least four separate organizations. The CID contract personnel, referred to as the Technical Assistance Team, were not able to function well as a team because the project structure resulted in the physical separation of most of the NCP personnel. Undoubtedly, greater interaction among CID personnel could have resulted in a better team effort, higher productivity, and better morale, both individually and collectively.

In spite of the complicated and cumbersome organization and administration, the NCP functioned moderately well and certain objectives were achieved. However, some of the conditions or situations which resulted directly or indirectly from the organization of the project, and which slowed the overall progress, were:

1. The generally poor communication among personnel engaged in implementation of the project

2. The making of important program decisions by individuals without full consideration of other viewpoints and extant commitments of team members

3. The inability, and therefore the failure, of the various organizational units of the NCP to function successfully as an integrated unit to achieve the goal of increasing production of cereals

4. The expectation that members of the NCP staff could assume responsibility for programs without the commensurate authority

5. Low morale among certain individual staff members, notably the agricultural engineer and the extension specialist

6. The focusing of NCP evaluations on the work and activities of the CID contract staff even though this group represented only one component of the project and had the least authority

The Role of the Agricultural Extension Advisor. -- The CID technical assistance staff of the NCP included an agricultural extension advisor. His role and function are briefly described in the following statement:

> This CID Specialist will be assigned as an Advisor to the Department of Agriculture Service. His activities will be particularly carried out within the general framework of agricultural extension in accordance with the priorities defined by the Department of Agricultural Sciences.

In reality, this statement is woefully inadequate in defining and clarifying the role of the extension advisor. At the time the NCP became operational, the primary direction of agricultural extension work for cereals production was from the national office of the Service of Agriculture. The extension component of the NCP was viewed as being essential to the Service of Agriculture in establishing an effective extension system to diffuse agricultural technology and facilitate its application by the farm population. Subsequently, the GON changed its approach for increasing agricultural production by establishing semi-autonomous productivity projects at the department level and assigning to them the primary responsibility for conducting agricultural extension work. No linkage was established among the NCP and the productivity projects to facilitate joint programming efforts. Given this change after the project started, the role of extension support to be provided by the NCP became less clear. Concomitantly, the extension advisor's role shifted from providing advisory assistance regarding extension organization and training at the national level to more general extension work of a less significant nature.

French Language Ability. -- The extension advisor's inability to communicate effectively in the French language was a definite constraint on the performance of that role. This deficiency was partly overcome through the use of interpreters and translators. The time required to translate all written communications into French was an added constraint on implementation of the program. This could have been alleviated by the use of capable bilingualists.

The NCP was fortunate to have GON coordinators who had studied in the United States and who were quite fluent in English. They were extremely helpful in bridging the language gap. In addition, the AID project manager and other project personnel spoke French well and assisted frequently. The inference can be reached easily that the language deficiency was greatly overemphasized and was used possibly as a diversion and an excuse for the failure of the GON agencies and personnel to achieve coordination and success in their extension activities. The expertise of an extension advisor would seem to be far more important than his language ability, especially in light of the fact that the language deficiency and constraint could have been overcome largely by use of a bilingual GON counterpart working with the extension advisor, a process which is in widespread use in assistance projects worldwide. Upon Mohamed Abdoullaye's return from the United States and his subsequent assignment to the NCP as extension specialist in January 1980, he was recognized as the counterpart to the extension advisor. As a result, there was considerable improvement in communications.

If the posture which existed during the era of Phase I of the NCP is maintained -- namely, that fluency in French is necessary for work in Niger -- the people of that country stand to lose much expertise from those many authorities who either may not possess fluency in French, who may not be able to achieve it for various reasons, or who may not want to divert the necessary time from their scientific and technical activities to achieve fluency. Logically and practically, the question can be asked, and should be studied, as to whether the scientific/technical or linguistic contributions can provide a greater benefit to Niger, especially when a very large percentage of the population speaks little or no French. Is the time devoted by the highly skilled agriculturalist to becoming fluent in French, or any other language,

cost-beneficial in terms of a contract of limited length? In these contexts, the most serious consideration should be given to making provision for the use of full-time bi- or multi-lingual personnel in the case of specialists who do not possess linguistic skills. The important points to us are to transfer agricultural expertise in the most efficient and cost-beneficial manners possible.

The Reluctance of GON Officials to Consider Available Options with Respect to Extension Strategies. -- The agricultural officials of the GON have been strongly committed to establishing only programs and services that have been designed according to their own perceptions of the country's particular conditions and problems. This could be a farsighted concept, provided it were structured in a manner which would encourage innovative ideas and approaches to agricultural development. Unfortunately, however, our experiences were that the Nigerien agricultural officials were reluctant to accept suggestions and recommendations for programmatic developments from outsiders because it was believed they did not understand Nigerien agricultural conditions and situations.

The development of an agricultural extension service in Niger capable of having a major impact on agricultural production requires a major planning and organizational strategy. In general, much pertinent information relating to this task is available from other countries that have had similar experiences. The expertise achieved in Morocco and Tunisia in developing seed multiplication programs, in connection with overall cereals production, is a good example. This kind of information, which can be provided by foreign technical personnel, should be utilized fully in determining the developmental strategy for agricultural extension.

Cooperative and Credit Advisor

The lack of Nigerien counterparts resulted in less than full development of the cooperative and credit program. Now that the technical advisor has departed, there may be no leadership for continuing the advancement achieved.

Additionally, the expansion of some programs was thwarted by a lack of understanding or a full appreciation of the project by the AID project manager. More meetings regarding the progress of the project would have provided the opportunity for better coordination and planning.

Agricultural Economist

Lack of success in the areas of economic studies is only relative. Had more resources been available, more and better economic studies, yielding more precise quantifications, could have resulted. Any lack of success in the area of agricultural economics must be attributed to the failures of project authorities -- AID and Nigerien -- to recognize earlier in the project the need for economic studies. Even at the end of the project, they were not sufficiently persuaded of such needs to allocate the economic resources adequate to result in an economics program comparable in scope and depth to the agronomic, seed multiplication, and extension teaching and support aspects of the project.

Consultants

Several months of consultant services to the NCP in Niger, and several years of service in other Sahelian countries, indicated to the consultants involved that the following problems constitute major obstacles to increasing production and availability of food in Niger and other Sanelian countries alike:

1. Yield-increasing technology is heavily dependent on imported and increasingly costly nitrogen and phosphate fertilizers.

2. Cultivars of major crops that are being promoted by the extension services and the productivity projects are sometimes no better than local cultivars. Efforts to promote these cultivars to increase field productivity were unsuccessful, and hence dilute the effectiveness of extension progress.

3. The potential that exists for livestock production to significantly contribute to the economy, and hence benefit from increased crop

production, is not widely recognized and therefore is exploited very little.

4. After harvest, storage procedures for grains and seeds permit major depredations by birds, rodents, and insects, which result in both deterioration of quality and reduction of quantities subsequently available for use.

5. The area of cropland that can be handled by a given labor crew is limited by the labor requirements of crop production, particularly in regard to weed control.

6. The maximum area of cropland that can be tilled in a given region is controlled by the capacity of long-continued brush fallow to restore the productivity of cropland after it has been depleted by traditional production methods.

7. Common lands used as pasture or range are relatively unproductive, particularly in the first few years after they are retired from use as cropland. Low productivity of the range imposes ceilings on the numbers of animals that can be supported.

4

Possible Solutions to Problems

It would be the height of naiveté to think that the solutions to problems encountered in developmental programs could be written out in cookbook fashion. The variability of ecological and sociological climates in any country precludes the anticipation of many problems and their solutions. Thus, it behooves all who may be involved in development programs to familiarize themselves with the experiences of others and to learn adaptive techniques in order to be as well prepared as possible to face obstacles which may be encountered, and when possible, to seek solutions to problems in the field.

It would also behoove the planners and administrators of developmental programs to become familiar with the kinds of problems which arise most often in order to prevent their occurrences and alleviate or reduce their impact.

Each of the CID team members has recorded the problems and frustrations encountered during the NCP and has given his views regarding possible solutions for overcoming such problems. We hope these ideas are constructive and helpful to future workers.

In general, the most serious problems appear to have been a lack of understanding or a misconception regarding the administration of the project. John Harvey stated it well in his review of the Niger Cereals Project:

> Implementation of the NCP involved three principal parties: the host country government, the AID country mission, and the contractor. Given these conditions, it is essential that the specific roles each principal

is expected to play be carefully determined and clarified and that responsibility with authority is delegated accordingly. Good working relationships among the three groups depend upon each party knowing and accepting its roles and responsibility.

In the case of NCP, the major problems and difficulties encountered stemmed from the failure at the beginning of the project to clarify roles and responsibilities of those involved in the project's implementation. This failure created misunderstandings and added to the confusion that existed during the five-year implementation process. A combination of factors contributed to this situation: (1) the GON insisted on operating the project according to their own desires with little regard for the technical assistance available to them; (2) there were differing opinions by each group as to how the project should be operated and expected outcomes; (3) the tripartite organization that emerged for implementing the project; (4) the AID mission's control and direction on contract personnel; and (5) the contractor's restricted function in project planning and decision making and limited ability to focus institutional resources on reaching project objectives.

Misunderstandings and confusion resulting from the above factors were manifested through regular project evaluations and monitoring, purchasing commodities, personnel selection and assignments, poor communications, the lack of a team approach in accomplishing objectives, and the inevitable frustrations among the project staff.

Other problems of implementation related to the project design process employed in AID-funded projects and the process for selecting the contractor to execute the project. The NCP was designed more than one year before the contract team arrived in the country to begin the implementation phase. And, as is typical, the contractor had not been represented on the project design team. This meant that the project team had to accept the previously designed project and be responsible for achieving a set of specified objectives that it had had no part in planning. Further, implementation of the NCP was well underway by AID mission personnel when the contract team arrived.

The mistakes made in the project design were incorporated in the contractual obligations and were difficult, if not impossible, to change. Project design and subsequent evaluations should have been subject to change throughout the implementation process and modifications made as knowledge was acquired and situations changed. The GON's attitude toward the NCP changed considerably between the time the project was designed and its implementation was underway. Once funding became available, the GON insisted on utilizing the money according to its own desires.

The CID technicians were told to prepare a work plan within their scope of the Project Paper. The GON had accepted the Project Paper but expected the CID team to function only as imported technicians within the existing governmental structure. This led to the often-mentioned "multiplicity of administration" and lack of coordination. CID expected its technicians to function as a team. Niger, not accustomed to the integrated research approach, saw this as a superimposition on their government structure.

The CID technicians, unable to function as a team, were also denied budgetary authority. Project funds were administered through the GON agencies. This prevented obtaining supplies, hiring labor, and meeting other needs of technicians accustomed to administering their own research and resources.

The inclusion of the contractor -- in this case, CID -- in the preparation of the Project Paper would have done much to reduce the administrative confusion. At least the feeling of the GON's reluctance to accept new policies would have been recognized, and with greater AID collaboration, a stronger project leadership could have been provided.

A mutual understanding on the use of counterparts between the contractor and the host country is essential for the success and future welfare of any assistance program. Trained personnel are a very limited resource in less developed countries (LDCs). Host governments must be convinced that development teams generally need as counterparts only semi-professional trainees who will learn from the technicians, rather than trained men who will merely apply local adaptations to the technician's program. Pre-contract discus-

sions among the host government, AID, and the contractor would be beneficial in this regard.

Again quoting John Harvey:

> Technical assistance provided by the United States to the countries of the Sahel for agriculture development will certainly greatly increase during the present decade. As the population increases in these countries, food needs cannot be met unless the present peasant agriculture is modernized and made more productive. Agriculture development in the region will continue to be adversely affected by world economic and marketing conditions, making it prohibitive to import the inputs that are essential for increasing agriculture production. Massive programs will need to be planned and implemented over long periods of time in order to meet the development needs of the countries. Experience has shown that small projects, even though successful, have little effect on overall development.
>
> American universities should play an important role in development of the Sahel for they are the institutions most closely associated with the science and technology that must be brought to bear on agriculture development in the region. Texas Tech University, as a primary source of scientific expertise on arid and semi-arid agriculture, had much to offer in assisting the countries of the Sahel to develop their agriculture. University assistance to the LDCs, with development programs, needs to be broad-based with greater involvement in the programming process, beginning in the project planning stages and continuing through implementation.
>
> In order for the university to have this kind of involvement, a different set of relationships will have to be established among the university, AID, and the host country than exists at present. Current AID policies and procedures do not make it conducive for universities to establish long-term cooperative relationships with particular AID country missions and host country governments for purposes of developing specific expertise and having greater and more effective involvement in

the programming process at the country level. Contracting with AID, only to implement a previously designed project for a specific length of time in an LDC, may not be the most desirable role for universities to assume.

In the mere implementaton of some technical assistance projects, universities may not be any better qualified than private sector contractors. Thus, it is more in keeping with the basic function of universities to assist LDCs in the development of indigenous institutions with the capacity for planning and problem-solving based on sound principles of research and education. A strong institutional base is essential for both the development of science and technology and the diffusion of technical knowledge and its application to the development process.

5

Summary of Accomplishments

Accomplishments of Phase I of the Niger Cereals Project were numerous and are summarized according to the disciplines involved. Definitive progress was made toward the three objectives of the project: (1) development of facilities and a practical organizational structure, (2) training of personnel, and (3) production of seed through practices available to the average Nigerien farmer.

Achievements of individual research and advisory personnel were:

AGRICULTURAL ENGINEER

1. Reviewed and modified construction plans for each seed multiplication center

2. Determined equipment needed for the SMCs and the foundation seed farm and placed orders for that equipment

3. Designed and supervised construction of buildings at Tarna Station

4. Redesigned the original irrigation system for the Lossa Foundation Seed Farm to provide more water at the outlets

5. Recommended use of tube wells and turbine pumps for supplementary irrigation on the SMCs

6. Studied and developed recommendations regarding a contour system of farming to counteract soil erosion at the SMC north of Maradi

7. Supervised extension of the dike (levee) along the Goulbi River to prevent annual flooding near Tarna Station

8. Conducted research on water conservation, including topics such as plant responses to timed irrigation, various irrigation levels, tilled and non-tilled slopes, weed control, and fertilizer applications at various times during the growing season, density response to available moisture, and utilization of available water on various slopes

RESEARCH PLANT BREEDER

Within the confines of the short duration of the project, which consisted of four growing seasons, the research plant breeder directed several achievements:

1. Collected the maximum germplasm pools of sorghum and millet from ICRISAT in India, Texas A&M Agricultural System, and later from the U.S. Department of Agriculture (USDA)

2. Conducted two years of testing in two soil types which resulted in identifying 10 open-pollinated lines of sorghum as candidates for release to the seed multiplication program

3. Initiated the 10 lines and presented data regarding them in the 1978 Annual Report (3)

4. Initiated work on a conventional plant breeding program utilizing two approaches:

    a. Diallel crosses among several lines with the first generations being grown out and evaluated

b. Crossing of open-pollinated cultivars into a cytoplasmic male sterile line

5. Conducted on-farm testing or "verification trials" (implemented later by the agronomists)

6. Participated in millet improvement during 1977

RESEARCH AGRONOMIST

1. Established a nationwide system for the comparative study of the performance of millet, sorghum, and cowpeas

2. Developed and conducted side-by-side varietal field tests of local and selected improved cultivars in different parts of Niger

3. Conducted agronomic research involving various fertilizer treatments, including rates of commercial nitrogen, local phosphates, and animal manure

4. Studied agronomic and economic results of intercropping and single-crop farming systems

SEED SPECIALIST

1. Designed and implemented a foundation seed farm at Lossa and five seed multiplication centers at Guéchémé, Doukoudouko., Magaria, Hamdallaye, and Kouroungoussa

2. Designed and supervised construction of houses, offices, and seed laboratories, storage and processing buildings, cattle stables, and equipment storage and maintenance buildings at the FSF and on the Guéchémé, Doukoudoukou and Magaria SMCs

3. Ordered and supervised installation of seed processing equipment

4. Equipped seed laboratories

5. Formulated a basic Seed Multiplication Program which has been used only to a limited extent

6. Produced sufficient M-2 seed on the SMCs to meet the requirement of the departmental productivity projects

7. Arranged production of M-3 seed by contract seed farmers during the last three years of project

8. Instigated a field inspection program and seed multiplication procedures

9. Developed a program of field days for instruction of farmers

10. Arranged for the training of two Nigeriens in seed technology at Mississippi State University and the training of three technicians in Cameroon with a three-week short course given by Mississippi State University

EXTENSION ADVISOR

1. Developed an outline for an extension program

2. Prepared basic publications and a training manual for para-professionals

3. Developed and implemented arrangements for the chief of extension to visit Nigeria to study a successful extension program

4. Implemented a training program for para-professionals

5. Provided mimeographed publications in French to the chief of extension on personnel development, social action, farmers' acceptance of new ideas, extension methods, themes for extension programs, and millet, sorghum, and cowpea production

6. Arranged for translation into French and distribution to extension agents of agronomic papers prepared by the seed specialist and agronomist

7. Developed outlines for a training program utilizing slides

8. Collaboratively developed, with the project coordinator, the chief of extension, and AID personnel, a training guide for aide-encadreurs ("field agents"), which provided for training, reporting, coordinating demonstrations, conducting field days; and field testing of the manual

9. Supervised setting up demonstrations for farmers near the seed centers

10. Assisted in training personnel of the Union Nigérienne de Crédit et Coopératives (UNCC)

11. Collaboratively developed, with the cooperative and credit advisor, the Proposal for a Learning and Information Center in the Ministry of Rural Development for the UNCC and Agriculture Extension Services

12. In conjunction with the seed specialist, developed and distributed sets of color slides of farming procedures on the SMCs to department agents

13. Acquired and appropriately distributed cameras, projection equipment and tape recorders, and art supplies for making posters

14. Assisted by AID employees, conducted an extensive study of the extension-type programs carried on by the Ministry of Rural Development and prepared a report and recommendations regarding those programs

15. Provided training in agricultural extension through:

    a. In-service training of agricultural personnel

b. Out-of-country training in the United States

c. Production of education and training materials

16. Assisted the chief of extension in the first National Conference on Agricultural Extension in Tahoua in 1980

COOPERATIVE AND CREDIT ADVISOR

1. Developed and proposed plans for organizational improvement of cooperatives, establishment of personnel training centers, provision of training seminars, and assistance in agricultural extension programs at the farmer level

2. Assisted in the development and nurturing growth of cooperatives

3. Trained UNCC encadreurs ("field agents")

4. Established departmental training centers

5. Trained cooperative personnel and administrators

6. Obtained legislation establishing the legal status of cooperatives

7. Organized a center for supply and distribution designed to improve efficiency in procurement and distribution of farm products

8. Distributed imported supplies through UNCC distribution centers

AGRICULTURAL ECONOMIST

No work was done on Nigerien agro-economics until one year before the end of Phase I, when five months of consultant time were allocated to problem definition, program description, implementation, and reporting. As a result, four reports were prepared, which:

1. Recommended an agricultural economics program for the project

2. Surveyed the economics of cereal production in Niger

3. Surveyed the economics of the Seed Multiplication Program

4. Presented a brief summary of the consultant's view of Niger's needs for increasing food production

6

Future Directions of Research

The four-year duration of Phase I of the Niger Cereals Project could only lay the foundation for future development. Each of the CID team members has suggested possible future activities for developmental progress in Niger.

PLANT BREEDER

Varietal development is a long, slow process. Utilization of materials from international research centers can aid in hastening the time to find superior plant characteristics and possible improved varieties for the country. Selections and lines from these centers are tested and observed by scientists in many environments of the world, some of which duplicate the conditions of Niger.

The continued screening of sorghum and millet germplasm lines for disease resistance to mildew, smut and Striga asiatica (witchweed) is an important activity. The importance of cowpeas should emphasize the need for collecting and screening varieties and germplasm lines of this crop.

It cannot be expected that the "perfect" variety for Niger will be found by testing varieties from the international centers. Refinements must be made by combining desirable varietal characteristics of local varieties with the improved characteristics of the introduced germplasm lines.

Because of the demonstrated higher yields of hybrid varieties of sorghum and corn in many countries, the development of hybrid seed parent lines of locally adapted varieties of sorghum should be started in Niger. Breeding

programs should include the objective of developing male sterile and fertility restoration lines. Comparative studies should be made of the performance of hybrid and pure line varieties.

AGRICULTURAL ENGINEER

Following the research program of the agricultural engineer in water conservation studies, it is evident that more effective utilization of available water is possible. Cultural practices must be determined for more effective infiltration and storage of rainfall on both the undulating sandy soils and the heavy lateritic soils.

The possibility and advantages of reforestation of the vast areas of lateritic soils should be studied. Range and livestock management studies are needed to meet the severe ecological conditions of the Sahel countries and yet provide economic production for these areas.

Feasibility studies for expanded and improved irrigation systems adjacent to the Niger River should be made. Utilization of solar energy for power sources should not be overlooked.

AGRONOMIST

The continuation of soil mapping and ecological descriptions of the agroclimatic zones is important to target variety and culture practice recommendations to specific areas. Such inventory mappings also help determine research needs and expansion to assure adequate coverage of agricultural research in the country. Expanded studies on the utilization of local phosphate rock are needed to determine the fertilizer effectiveness and possible processing procedures required to improve fertilizer availability. This important source of locally available phosphate fertilizer should be made available to Niger agriculture.

Cyril Brown recommended that a training program -- as determined by a survey of projected needs -- should begin in Niger for a selected number of students in basic sciences. This program of training need not be tied to any partic-

ular project, but would be the pool from which graduate students could be drawn for specific programs. There is no certainty that there is one single undergraduate Nigerien studying biochemistry today, but any program on biological nitrogen fixation has need for such a trainee.

Alex Cunard suggested agronomic research be aimed at low energy cost and efficient utilization of fertilizer, i.e., (1) hand- and animal-traction cultural practices, (2) spot placement of fertilizer, (3) exploitation of nitrogen fixation of legumes, (4) improved phosphate availability of biological organisms, and (5) utilization of intercropping systems.

Both scientists stated that research emphasis should be given to a farming systems approach in which a multidisciplinary effort should be made to solve the problems in developing countries. Initially, every effort should be made to study the prevailing agro-ecosystem at ground level, among the peasant farmers. The findings from this initial study should then be evaluated, discussed and analyzed, and the various bottlenecks, hindrances and constraints to higher production should be identified. Personnel from all disciplines need to be involved. Other succeeding steps in the developmental process will be greatly hampered if this first step is not taken. The importance of economic analysis that should be applied to all recommendations ultimately made cannot be overemphasized.

SEED SPECIALIST

The activation of the National Seed Coordination Committee and the leadership of the chief of the Seed Multiplication Program can do much to forward the program of seed multiplication. The acceptance of a seed policy statement, with guidelines for coordinating the activities of the agencies, would further the development of a functional program. Improved M-0 seed could be obtained if INRAN would restrict the amount of seed produced and practice the proposed varietal maintenance techniques.

Demand for improved varieties and high quality seed is being created within productivity projects. Integration of their seed programs with the national program would provide a market for SMC M-2 seed and a uniform application of

the seed quality regulations. Utilization of the UNCC financial structure and distribution facilities would enhance the purchase and sale of M-3 seed at the contract grower and farmer level. Better pricing and purchasing policies must be established. These activities can be brought about only by the coordinating action of the national seed committee.

Of primary importance to the success of the Seed Multiplication Program is the development and training of additional personnel. Training facilities and programs have been proposed by the Food and Agriculture Organization (FAO) of the United Nations (18) but have not been implemented. It has been suggested the facilities at the foundation seed farm could be converted to a training center. If INRAN continues to produce the amount of seed it is now doing at Tarna, the intermediate stage between research and the SMCs is not needed. An alternative would be to have the foundation seed farm closer to the Centre National de Recherche Agronomique at Tarna which was originally recommended (19).

The development of a seed production and technology training center would facilitate training Nigerien personnel. Niger could well become a training center for West Africa with the anticipated increase of plant breeding programs by ICRISAT and the International Institute for Tropical Agriculture (IITA).

Closely associated with the Seed Multiplication Program should be the development and/or enlargement of the agriculture and seed industry, composed of importation and marketing of inputs, i.e., implements, insecticides and fertilizers, the manufacturing and maintenance of locally adapted equipment, and commercialization of agriculture production. This may occur either as a governmental function or in the private sector. In Niger, it would appear the former is more apt. Supporting and strengthening the UNCC Centrale d'Approvisionnement as described by Cao Quan (20) would improve the efficiency and development of such an industry.

EXTENSION SPECIALIST

A number of recommendations are believed pertinent to the on-going development of agricultural extension in Niger. Most of the recommendations are broad in scope and are meant to suggest general areas where improvements are believed to be necessary for a stronger extension program to result. In a general way these recommendations relate to the problems and constraints discussed or alluded to in earlier sections of this report.

Develop a National Strategy for Agricultural Extension

High priority should be assigned to developing a national strategy for establishing an agricultural extension system capable of having a major impact on agricultural production throughout the country. The following questions are indicative of the many considerations that should go into the preparation of a national strategy:

1. What should be the common philosophy to guide agricultural extension and make it a dynamic rural service?

2. What type of organizational structure will be the most effective?

3. What kinds of personnel will be required to perform the various extension roles and what level of qualifications and skill will be needed?

4. How can the programs of various government services and semi-autonomous projects that serve agriculture be effectively coordinated and/or integrated and focused on the achievement of common goals?

5. What will be the most effective use of limited government resources?

6. Should the concept of agricultural extension be enlarged to encourage programs of a comprehensive nature?

Emphasize Training of Extension Personnel

The successful implementation of agricultural extension programs requires adequately trained personnel. In-service training needs to be provided on a continuous basis for all personnel doing extension work. Primarily, the special abilities and skills required by agricultural extension personnel are of two types: first, a knowledge of what to teach (content) and second, an understanding of how to teach (method). Content is the subject matter or technology that is important for the farmer to understand, while method is the means and skills used to teach the subject matter. Both content and method are equally important if extension work is to be successful. The most feasible way for extension personnel to acquire these abilities and skills and keep up-to-date in their knowledge is through well-planned in-service training.

Training programs for para-professional extension personnel need to be carefully planned because of the low educational level and specific role the para-professionals are expected to play. It is suggested that para-professional personnel be given eight weeks of in-service training throughout the year. For all para-professionals, four weeks should be in a national training program at the Kolo Agricultural School. The remaining four weeks should be utilized during each three-month period by conducting one week of training for small groups of para-professionals within their work area. Existing training facilities, such as CFJAs and CPRs, should be utilized in the local areas for this training.

In order to meet the growing need for more highly qualified personnel, a larger number of participants should be sponsored to the United States for long-term academic training in subject areas required for successful functioning of agricultural extension education.

Establish an Extension Program Support Unit at the National Level

The outcome of all agricultural extension programs depends to a large extent upon the field staff members who are in daily contact with their farm

clientele. These local extension agents must have various kinds of assistance and support if they are to be effective in teaching farmers new agricultural technology and farm practices.

An extension program support unit needs to be established at the national level to provide to the field staff a steady flow of current information with respect to recommended production technology and practices that local agents can use in teaching farmers. Other functions of a program support unit should include:

1. Gathering pertinent research data from all sources and "packaging" it for dissemination to farmers through the extension system

2. Preparing training materials

3. Promoting the agricultural extension program through the press, radio, and television

4. Conducting limited field studies and evaluations to determine the impact of the agricultural extension program on increasing agricultural production

Clarify the Relationship of Semi-Autonomous Productivity Projects to Other Agricultural and Rural Development Services

The government strategy for agricultural and rural development emphasizes the establishment of area-specific productivity projects as the vehicle through which rural programs are to be implemented. Productivity projects have been established in five of the seven departments and additional ones are planned. These projects, however, do not as yet encompass the entire department but operate in selected areas of high agricultural potential. All productivity projects have international funding and are under semi-autonomous management authority. There is uncertainty in the minds of personnel of other organizations and services about their relationships to the productivity projects.

As to the NCP, linkages need to be forged to establish clear lines of communication and close working relationships. Such relationships should have mutual benefits because of the commonalty of project purposes and goals. Through joint planning and coordination with the productivity projects, each component of the NCP could function more effectively. With respect to the agricultural extension component, joint planning and coordination of the program effort is essential.

COOPERATIVE AND CREDIT ADVISOR

In various reports submitted to the NCP regarding assistance which might be provided UNCC during the second phase of the project, the cooperative and credit advisor's recommendations follow:

The Creation of a National Training Center

At the present time UNCC has relatively enough staff and field agents. In the future, with the expansion of the cooperative structures to cover 100 percent of the rural area, an increase in the number of trained agents will be needed.

Existing agents should receive additional training and retraining in order to enable them to teach farmers and cooperative members the principles of cooperation, improved production, techniques, supply, and marketing procedures.

To obtain desirable results, UNCC will need more people qualified to supervise and follow up the work of the field agents. In addition, the concept of cooperative self-management has been implemented in some areas of Niger to make cooperatives more effective; cooperative members must be able to manage their own businesses. They should participate in all activities of their organization and express their ideas about running the cooperative activities.

In the future, field agents must conduct an extensive training program for farmers at every cooperative level, in order to meet this objective and to promote new changes to move the rural population toward greater development.

The creation of a national cooperative center will help the organization develop new training strategies for farm leaders and cooperative members by upgrading the general level of education and capability of UNCC personnel.

NCP Assistance to Strengthen the Center of Supply and Distribution of Farm Inputs (Centrale d'Approvisionnement)

The Ministry of Rural Development established the Centrale d'Approvisionnement in 1978 to handle the importation and distribution of agricultural inputs -- such as fungicides, fertilizers and farm equipment -- to farmers for the purpose of increasing agricultural production.

In order to help this institution effectively achieve its objectives, the NCP should consider establishing an office complex and storage and transport facilities at the center.

Of course, the training of the personnel in stock management, logistical support, marketing, and delivery is considered an important aspect for making the center operate more efficiently.

7

Conclusions

Niger is a particularly interesting country to Texans because the climate is arid and semi-arid, as in West Texas; the average rainfall at the capital of Niamey is about 46 centimeters, the same as Lubbock; the major cereal crop is grain sorghum, as in the High Plains; and there is a striking resemblance between parts of southern Niger and the southern High Plains of Texas.

Therefore, the Niger Cereals Project provided an unparalleled opportunity for faculty of Texas Tech University to expand their professional horizons and introduce new perspectives into their campus teaching and research programs. Twenty-two faculty members served short-term and long-term assignments in Niger. Four others had a close involvement with the project in their capacities as on-campus project directors and liaison personnel. Dozens of other Tech faculty have been informed through seminars, personal contacts, and progress reports about agricultural and cultural conditions in a relatively little-known part of Africa. As a result, new courses with an international dimension have been introduced and other courses have been changed to give students a better idea of the interdependence of the Texas and world economies.

Additionally, although pearl millet is an important crop in Niger, grain millets are practically unknown in Texas, although a small hectarage is grown for birdseed near Lubbock. Pearl millet deserves serious study as a potential short-season, drought-tolerant crop because: (1) it possesses a high degree of drought tolerance, a genetic characteristic that has much significance in the High Plains of Texas and the Great Plains of the United States and Canada, and (2) because its nutritional composition makes it suitable for

livestock feeding as well as for human food. A number of millet varieties from Niger and neighboring countries -- varieties which have a great variation in growth habit and yield potential -- were identified. Their performance under various conditions in the Great Plains and other arid and semi-arid regions of North America should be investigated scientifically.

Participation in the Niger Cereals Project contributed to the expansion of the Texas Tech master's degree emphasis on arid lands studies by attracting students who became aware of the university's involvement in Niger. That involvement also played a major role in the selection of Texas Tech University as one of the initial group of 18 U.S. universities receiving $100,000-per-year Strengthening Grants from the Agency for International Development. The exposure which the university received from its association with the Niger Cereals Project and the Consortium for International Development also acquainted many people for the first time with aspects of its agricultural and other academic areas.

The technical accomplishments in Niger were many, despite the problems and frustrations that seem to be inevitable accompaniments to overseas activities. Of particular significance were:

1. The establishment of a successful seed improvement enterprise

2. The beginning of a producer-oriented extension program

3. Research on water conservation and irrigation practices adapted to local conditions

4. Collection of a sorghum and millet germplasm pool from throughout the world

5. Initiation of an intensive plant breeding program with open-pollinated lines

6. Development of the first nationwide system for the performance comparison of varieties and strains of grain sorghum, millet, and cowpeas

7. Initiation of an off-station crop production testing program based on a farming system approach

8. Strengthened training and distribution functions of the national agency for cooperatives and farm credit

9. Preparation of a proposal on the collection and analysis of data for evaluating the economic impact of government agricultural policies and research.

Training was, as it must be in any technical assistance project, a major formal and informal aspect of the Niger Cereals Project. Formal training was imparted: (1) through meetings sponsored by the extension service of the Ministry of Agriculture, the Seed Multiplication Program, the national organization for cooperatives and credit (UNCC), the national institute for agricultural research (INRAN), and the national research station (CNRA); and (2) by sending young Nigeriens to the United States for graduate education. Informal training was a continuing function of the Texas Tech team members in their contacts with senior and junior administrators, research personnel, farm laborers, and farmers. The informal contacts probably were the most effective ones in terms of sharing knowledge and attitudes and in making enduring friendships.

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11. Richard Vengroff. Preliminary Evaluation of the Consortium for International Development Component of the Niger Cereals Project. February 1977.

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13. Frank LeBeau. Cover letter of transmittal with Report on the Second Evaluation of the Niger Cereals Project. February 1978.

14. Dan Aronson. In Report on the Second Evaluation of the Niger Cereals Project. January 1978.

15. A. Daaloul. In Report on the Second Evaluation of the Niger Cereals Project. January 1978.

16. Carl Ferguson. Memo from Agricultural Sector Assessment Team. November 1979.

17. Cyril B. Brown. Perspective of Niger Cereals Project. 1980.

18. G.E. Delhove. Report on the Introductory Mission to Niger - February 27 to March 8, 1978. FAO, Rome. 1978.

19. Howard C. Potts. Report for Project Paper. 1975.

20. Cao Quan. Cooperative Development and Training in Niger - End of Tour Report. June 1980.

Appendix 1
Personnel Involved in the Niger Cereals Project

Abba, Moussa. GON Project Coordinator, 1977-1979.

Abdoullaye, Mohamed. GON Extension Specialist, 1980.

Albin, Robert. Consultant. Associate Dean, College of Agricultural Sciences, Texas Tech University.

Allen, B.L. Consultant. Department of Plant and Soil Science, Texas Tech University.

Amadou, Garba. Director General, UNCC.

Anderson, Bruce. Executive Director, Consortium for International Development, Logan, Utah.

Baron, Albert. AID Mission Director, 1975-1977.

Bennett, W.F. Consultant. Associate Dean, College of Agricultural Sciences, Texas Tech University.

Bertrand, Anson R. Technical Coordinator, 1976-1979. Dean, College of Agricultural Sciences, Texas Tech University.

Bishop, James. U.S. Ambassador to Niger, 1979-1981.

Brown, Cyril B. CID Research Agronomist, 1976-1979. Department of Agronomy, Texas Tech University.

Burke, Kevin J. AID Desk Officer.

Burzlaff, Donald. Consultant. Department of Range and Wildlife Management, Texas Tech University.

Charlick, Robert. Consultant. Cleveland State University.

Clem, Gary. Consultant. Allan Machine Co., Ames, Iowa.

Cunard, Alex C. CID Research Agronomist, 1979-1980. Mississippi State University.

Curl, Sam E. Technical Coordinator, 1979-1980. Dean, College of Agricultural Sciences, Texas Tech University.

Davenport, James. Consultant. Department of Mathematics, Texas Tech University.

Dickherber, Harry. AID Liaison Officer.

Dregne, Harold E. AID Interim Project Director, 1978-1979. Director, International Center for Arid and Semi-Arid Land Studies, Texas Tech University.

Enger, Warren J. Consultant. Soda Springs, California.

Fischer, John L. Coordinator, Africa Program, Consortium for International Development (currently CID Executive Director).

Foerster, Eugene P. Agricultural Engineer, 1976-1979. Department of Agricultural Engineering, Texas Tech University.

Garba, Zachary. Director General, INRAN, Ministry of Rural Development, Government of Niger.

Garner, Norman. AID Acting Project Manager, 1978-1980.

Hall, William E. CID Seed Specialist and Chief of Party, 1978-1980. Oregon State University.

Harvey, Clark. CID Research Plant Breeder, 1976-1978. Department of Plant and Soil Science, Texas Tech University.

Harvey, John J. CID Agricultural Extension Advisor, 1978-1980. Arlington, Virginia.

Henrie, Bernie. Acting Executive Director, Consortium for International Development (currently CID Deputy Director).

James, Charles. Ambassador to Niger, 1976-1979.

Johnson, Jay P. AID Mission Director, 1977-1979.

Jones, J. Knox, Jr. Vice President for Research and Graduate Studies, Texas Tech University.

Krieg, Dan. Consultant. Department of Plant and Soil Science, Texas Tech University.

Lamborn, Reuel E. Consultant. Director, Soil, Plant and Water Analysis Laboratory, Utah State University.

Lennon, Max. Associate Dean, College of Agricultural Sciences, Texas Tech University.

Livingston, James. AID Agricultural Development Officer; AID Project Manager, 1976-1978. University of Arizona.

Mahamane, Salifou. GON Project Coordinator, 1975-1977.

Meenaghan, George F. Associate Vice President for Research, Texas Tech University.

Mezynski, Paul R. Consultant. Texas State Technical Institute, Waco.

Miller, Dwane. Consultant. Chairman, Department of Plant and Soil Science, Texas Tech University.

Murray, Grover E. AID Project Director, 1979-1981. University Professor, Texas Tech University.

Panwalkar, Shrikant S. Consultant. Department of Industrial Engineering, Texas Tech University.

Quan, Cao. CID Cooperative and Credit Advisor. Utah State University.

Raullerson, Calvin H. AID Project Director, 1976-1978. Executive Director, International Center for Arid and Semi-Arid Land Studies, Texas Tech University.

Reeser, Robert M. Consultant. Ohio State University.

Saley, Moussa. Director General, Service of Agriculture, Ministry of Rural Development, Government of Niger.

Stoner, Ben. AID Project Officer.

Traylor, Idris R., Jr. Deputy Director, International Center for Arid and Semi-Arid Land Studies, Texas Tech University (currently ICASALS Director).

Vengroff, Richard. Consultant. Department of Political Science, Texas Tech University.

White, Larrie D. Secretary/Treasurer, Consortium for International Development.

Williams, James E. CID Extension Advisor and Chief of Party, 1976-1978. University of Arizona.

Appendix 2
Reports and Papers Resulting from the Niger Cereals Project

Proposition pour la 2eme Phase du Project Cerealier. No date.

Le Sorgho. No date. Mimeographed, 5 p. (French).

Brown, C.B. No date. Les Semis du Mil, Parts I and II. Mimeographed, 5 p. (French).

Brown, C.B. No date. Preparation du Sol pour le Mil. Mimeographed, 3 p. (French).

Three-Year Program, 1976-1978. No date. Government of Niger. Photocopied, 10 p.

Hall, W.E. No date. Progress of the Seed Multiplication Program. Photocopied, 5 p.

Hall, William E. No date. Serie de Conferences sur le Programme de Multiplication des Semences.

I. L'Importance de la Semence dans l'Amelioration de l'Agriculture. Mimeographed, 4 p. (French).

II. Le Dévelóppement des Varietes Nouvelles. Mimeographed, 5 p. (French).

III. Le Programme de Multiplication des Semences. Mimeographed, 9 p. (French).

IV. L'Inspection du Champ et les Essais au Laboratoire. Mimeographed, 9 p. (French).

V. Le Conditionnement des Semences. Mimeographed, 13 p. (French).

VI. La Distribution et l'Economie des Semences Ameliorees. Mimeographed, 7 p. (French).

Williams, James E. No date. Le Processus d'Action Sociale. (Adapted from Kansas State University extension publication.) Mimeographed, 8 p. (French).

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Quan, Cao. 1976. UNCC Plan of Work. Photocopied, 14 p.

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Saley, Moussa. 1976. Note to the Extension Branch of the Service of Agriculture on the Cereal Seed Project in the 1977/1978 Plan of Work proposed by AID. 15 December 1976. Photocopied, 3 p.

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Themes de Vulgarisation Proposes et Recommandations pour 1977, Le Sorgho. 1977. INRAN (compiled from two other bulletins by Chief of Extension Assoumane Baoua).

Themes de Vulgarisation Proposes et Recommandations pour 1977: Sorgho. 1977. INRAN. Mimeographed, 2 p. (French).

Themes de Vulgarisation Proposes et Recommandations pour 1977: Mil. 1977. INRAN. Mimeographed, 2 p. (French).

Themes de Vulgarisation Proposes et Recommandations pour 1977: Niebe. 1977. INRAN. Mimeographed, 2 p. (French).

Williams, James E. 1977. Idees a Developper par le Personnel de Vulgarisation pour ce qui Concerne les Ateliers. Mimeographed, 11 p. (French).

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Murray, Grover E. 1979. 1979 Project Report: Consortium for International Development Niger Cereals Project. Photocopied, 5 p.

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Harvey, Clark. 1980. Niger Cereals Project - Final Project Report. Original, 11 p.

Harvey, John J. 1980. Review of Niger Cereals Project. Original, 9 p.

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Reeser, Robert M. 1980. CID in the NCP: Retrospective and Recommendations. Original, 11 p.

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Cunard, Alex. 1980. Intercropping with Millet and Groundnuts in the Sahelian Zone (presented at ASA meeting in Detroit, Michigan, December 1980). Photocopied, 11 p.

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