



**FINAL ADMINISTRATIVE REPORT**

**NIGER CEREALS RESEARCH PROJECT**

**CONTRACT NO. 683-0225**

**1982 - 1988**

**INSTITUT NATIONAL DE RECHERCHES AGRONOMIQUES DU NIGER  
PURDUE UNIVERSITY  
ALABAMA A&M UNIVERSITY  
AGENCY FOR INTERNATIONAL DEVELOPMENT**



IN PARTNERSHIP:

INSTITUT NATIONAL DE RECHERCHES AGRONOMIQUES DU NIGER  
WITH  
PURDUE UNIVERSITY  
AND  
ALABAMA A&M UNIVERSITY

IN COOPERATION WITH:

THE GOVERNMENT OF NIGER  
AND  
THE UNITED STATES AGENCY  
FOR INTERNATIONAL DEVELOPMENT

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**Submitted by  
International Programs in Agriculture  
Purdue University**

**1989**

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# EXECUTIVE SUMMARY

In November 1982, Purdue University and Alabama A&M University launched a major institution-building project, the Niger Cereals Research Project (NCRP). This project, conducted under a host country contract with the Government of Niger and the *Institut National de Recherches Agronomiques du Niger* (INRAN), was funded by the U.S. Agency for International Development.

In its long-range development plan, the Government of Niger (GON) gave top priority to food self-sufficiency. This was conceived in the short term as producing enough food grains (sorghum, millet, cowpeas) during years of normal rainfall to meet the needs of the population, and in the long term, as being able to accumulate enough surplus stocks during good years to overcome deficits experienced in bad years.

Since its inception in 1975, INRAN has been charged with the principal responsibility for conducting agricultural research in Niger. If the country is to achieve its rural development goals and attain food self-sufficiency, INRAN must become an innovative and productive research institution capable of developing improved and adoptable agricultural production technologies.

INRAN faced a number of constraints in providing improved technology for the agricultural sector: first, a shortage of trained scientific manpower; second, difficulties in effectively mobilizing its available resources; third, insufficient interdisciplinary, problem-oriented research on agricultural problems of high priority; and fourth, research not focused on site-specific agricultural production constraints.

It was within this framework that the NCRP was designed, with institution building as its principal goal. Cooperative effort was necessary to promote change which would allow INRAN to become a highly productive research organization. Strengthening INRAN's research capacity required a number of major changes such as:

- an increase in the institution's human resource base
- a strengthened administrative and management base
- an increased capability to provide technical support functions for research
- development of strengthened research-extension linkages to provide farmers with useful technology packages
- expansion of linkages between INRAN and the international scientific network

## INRAN AS AN INSTITUTION

Charged with the principal responsibility for conducting agricultural research in Niger, INRAN inherited research programs and facilities developed by the French *Institut de Recherches Agronomiques Tropicale* (IRAT). The research programs and form of institutional organization which IRAT had developed were not oriented to the current needs of Nigerien farmers. IRAT's main goal was to increase productivity of export crops by using the expertise of a trained staff adequate in number to accomplish the goals of the organization.

Prior to 1982, INRAN's goal was to provide disciplinary research results on food crops based on trials conducted on-station in much the same fashion as their predecessors had done in programs dealing with export crops.

During the 1975-1982 period, there was minimal progress in integrating scientifically sound food crop research into programs which were useful to the farmer clientele of INRAN.

From 1975-1985, INRAN was first linked nationally to the Ministry of Rural Development and later to the Ministry of Higher Education and Research. Neither was judged appropriate to enable the Institute to meet national goals of food self-sufficiency.

### NIGER CEREALS RESEARCH PROJECT: ITS ROLE IN INSTITUTION BUILDING AND INDUCED CHANGE IN INRAN

Institution-building projects may involve the use of a long-term expatriate team of experienced research personnel. Such was the case with NCRP. It initially utilized the experience and expertise of an agronomist-team leader, production agronomist, plant breeder, and two agricultural economists. A second agronomist was added to the expatriate team mid-project. The team was divided between INRAN's two major research stations, Kolo and Tarna. The NCRP technical assistance team not only had the responsibility of conducting collaborative research, but also of being directly involved in other activities which would contribute to attainment of the institution-building objectives. During the life of project, 26.0 person-years of long-term assistance aided INRAN in pursuing its mission. In addition, 233.8 person-weeks, or 4.4 person-years, of short-term assistance complemented the long-term team and assisted in training and research in a variety of disciplines.

It is a recognized axiom that usually it is necessary to develop adequate numbers of professional staff in order to institutionalize a research organization in a developing country. INRAN lacked adequate numbers of professional agricultural scientists. In 1980, there were 627

INRAN employees, including administrative and farm assistants. There were only four (4) persons with doctorate degrees, 15 with bachelor of science or master of science degrees, and 55 others with formal technical training.

To help correct the deficiency, 22 Nigeriens were scheduled for academic training for either the B.S., M.S., or PhD degree. The goal was to provide basic scientific manpower in critical disciplines. Of the 22 degree-objective students trained,

- 11 completed the requirements for the B.S. degree
- 7 completed the B.S. and M.S. degree programs
- 2 completed the PhD

The number of researchers was increased by nine, and the number of agricultural technicians was increased by 11. Six of eight INRAN department heads have been, or are in the process of, completing additional formal long-term educational programs for advanced degrees initiated under the NCRP. In the absence of these department heads, other INRAN staff have taken on administrative responsibilities.

The training programs under NCRP enhanced the research capability of INRAN and brought about a major change in the scientific philosophy of members of the INRAN staff. The program served to emphasize the value of education in science as a means of promoting new and more relevant research programs within the institution.

The NCRP design team recognized that there were many examples of professional research activities conducted by Nigerien and expatriate workers alike, although little of that output benefitted the farmer. Part of the problem resided with an inadequate extension system, but the main problem concerned the nature and relevance of the research which had been conducted. Analysis of the research programs indicated a needed change in research strategy to produce appropriate technological output which would be packaged for different farming systems in Niger.

As a result of the planning and guidance of the NCRP technical assistance team, in collaboration with their counterparts, a major change was effected in INRAN. Rather than conducting research oriented to specific disciplines, INRAN began to emphasize multidisciplinary research on priority problems constraining resource productivity.

The multidisciplinary research program was designed to overcome existing problems and to establish new institutional priorities by developing new research strategies which would eventually result in technologies benefitting Nigerien farmers. Multidisciplinary research offered the best approach to alleviating constraints to food crop production. Within this framework, there were three main research initiatives: (1) commodity research, from which improved varieties of acceptable quality would provide potentially increased productivity, (2) cereal production systems, which would provide agronomically sound production practices specific to the principal ecological zones of Niger, and (3) farming systems research, using on-farm trials to establish

acceptability of new technologies. Intercropping was a high priority research effort of the multidisciplinary research program

Five technical committees were established to advise on research programs in the areas of (1) millet (2) sorghum (3) legume crops (4) irrigated crops and (5) farming systems research. These technical committees developed work plans and multidisciplinary research programs based on priority research needs.

Research was aimed at specific "recommendation domains", i.e., different agro-ecological regions; this was counter to previous INRAN research which attempted to develop a technical package designed to be useful for the entire country.

Advances by INRAN, with the assistance of the NCRP expatriate team, include:

- a better definition of the constraints to agriculture in Niger besides those imposed by the environment, i.e., economic and agronomic limitations
- the development of alternative strategies for farmers to enable them to increase production in the face of these constraints
- an increase in INRAN's overall research capability in all areas of agricultural research.

Constraint identification resulted from the multidisciplinary efforts of the expatriate team and their Nigerian counterparts within the INRAN farming systems program (FSR). The end result was the recognition of recommendation domains based on farm models, taking into consideration the varying agro-ecological conditions in Niger.

The INRAN commodity program provided improved varieties of sorghum, millet, and cowpeas. In addition, hybrid sorghum varieties which outyielded traditional varieties were developed. Within these commodity programs, disease and insect resistance was identified, as well as resistance in sorghum to the parasitic weed *Striga*.

Alternative technologies were developed from the commodity program, FSR programs, and cereal production systems research to provide Nigerian farmers with improved higher-yielding varieties in combination with improved agronomic packages. Studies involved intercropping technologies based on research which considered plant density, mixes of plant species, planting geometry, fertilizer, pesticides, water retention, and animal traction.

The technological packages were tested and demonstrated to farmers through their participation in on-farm trials. Diffusion of results through the farming communities served as "outreach" or extension of new technological packages. Thus, NCRP research efforts implemented change in the research program, the results of which were:

- appropriate for farm use, and
- which realized increased cereal production compared with traditional methods.

An excellent example of the results of these interdisciplinary efforts is INRAN's *Fascicule No. 1., Stratégies alternatives pour la production de mil/niébé pendant l'hivernage* (Alternative Strategies for the Production of Millet and Cowpeas During the Rainy Season). This publication provides four alternative strategies based on technological packages recommended for different agro-ecological zones delineated on the basis of the onset of seasonal rainfall. The research on which these recommendations were based considered constraints identified through the FSR program.

The audience for whom the *fascicule* was developed included extension agents, technicians and farmers. Its publication established a useful dialogue between INRAN and its clientele. The *fascicule* represents a new approach by INRAN in the diffusion of recommendations.

An important institutional change was the adoption of a management structure which included greater staff input. The long-term technical assistance team, working collaboratively with INRAN counterparts, devised a committee structure with defined advisory responsibilities to the Director General (DG) of INRAN. The four committees provided input in the areas of (1) commodity purchase and management, (2) long- and short-term training, (3) library and documentation, and (4) short-term technical assistance assignments. Every INRAN research scientist and senior administrator served on one or more of these committees.

These administrative committees also performed an important function as reviewers of proposals by INRAN Department Heads and NCRP staff for the allocation of resources.

This committee structure is one example of the effort to decentralize management by spreading responsibilities over a wider range of personnel. More productive institutionalized programs and valuable administrative experience result. This decentralized approach was a substantial change from the internal management structure extant in 1982.

Computer technology was introduced to INRAN. The use of computers in this organization was new. It was implemented to bring the Institute up to state of the art in management and data analysis. Now, computers and computer technology are an expected part of everyday operational procedures. Upgrading is ongoing to maintain state-of-the-art capability.

An important aspect of institution building is informal in-country training provided by expatriate staff. Computer training sessions were an example of this type of hands-on training. Following initial computer familiarization and training, mid-level cadres at the Tarna Experimental Station in Maradi were trained in the use of database management and spreadsheet software for farm survey analysis. Likewise, INRAN staff in Niamey were trained in the use of BTOS, MULTIPLAN and MSTAT software packages.

Research technical support functions were strengthened by improving physical facilities at INRAN's Kolo and Tarna Experiment Stations. In addition, a cereals quality laboratory was established outside Niamey, as was a recently completed library/documentation center at the same site. Additional library reference materials and equipment were acquired. Equipment to upgrade the INRAN research effort cost more than \$500,000.

In 1985, INRAN became a part of the Ministry of Agriculture. This linkage is more appropriate to current objectives and long-term goals of the Institute as well as long-term governmental development plans.

Other operative national linkages were established with the University of Niamey, which provided work experience with INRAN to agronomy students, and with the National Office of Hydro-Agricultural Development (ONAHA), which collaborated on perimeter irrigation.

Short-term assistance was provided through institutional linkages with the Collaborative Research Support Programs (CRSPs), such as the International Sorghum and Millet Research Program (INTSORMIL) and the Tropical Soils Collaborative Research Program (TROPSOILS); through linkages with International Agricultural Research Centers (IARCs) and other international projects; and through Purdue, Alabama A&M and other universities.

Of the 4.4 person-years of short-term technical assistance, INTSORMIL contributed 3.1 person-years from its collaborating universities. This assistance involved various technical disciplines such as sorghum improvement, agronomy, plant pathology, entomology, and plant physiology.

NCRP provided some administrative backstopping of INTSORMIL personnel in the field. NCRP also provided logistical support to two TROPSOILS long-term personnel through a Memorandum of Understanding between Texas A&M University and Purdue University. These researchers collaborated with NCRP and INRAN staff in soil research.

Linkages with the IARCs such as the International Institute for Tropical Agriculture (IITA) and International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) provided new germplasm--cowpea, sorghum, and millet--which was incorporated into NCRP commodity improvement programs. Cowpea resistance to the cowpea weevil is but one example of the successful use of IARC germplasm in crop improvement in Niger.

NCRP also collaborated with the International Fertilizer Development Center (IDFC) on fertilizer studies conducted jointly on sorghum and millet/cowpea intercrops. These studies demonstrated that if available moisture is present, fertilizer can increase yields of crops grown on the relatively poor soils of Niger.

## CONCLUSION

The Niger Cereals Research Project attained many of the goals envisioned at the time the project was designed. NCRP implemented evolutionary change in INRAN which resulted in:

- improved institutional management and research support
- increased numbers of trained professional scientists
- better trained technical assistants
- improved facilities and equipment
- improved sorghum varieties and agronomic practices incorporated into technological packages for specific recommendation domains
- general strengthening of the Institute to provide useful technology to Nigerien farmers in future years.

Finally, the ultimate GON goal of increased food grain productivity should be realized through INRAN-developed agricultural technologies.

## NIGER APPLIED AGRICULTURAL RESEARCH PROJECT (NAARP)

The Niger Applied Agricultural Research Project is a follow-on project designed for continued support of INRAN and GON long-term goals. NAARP is an elaboration of institution building activities begun under NCRP, broadened to include irrigated agricultural research and improved research/extension linkages. This research will further develop and increase agricultural productivity.

Additional strengthening of INRAN's management capabilities is planned or in process, and includes research station management operations, short-term training of technicians, and strengthening of extension linkages and systems.

Long-term degree training programs will augment the number of INRAN professional personnel in disciplines where a critical shortage of trained manpower exists.

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## LIST OF ACRONYMS

AGRHYMET	Agro-Meteorological-Hydrology Data Collection and Forecasting Center in the Sahel, Niger
CILSS	<i>Comité Permanent Inter-états de la Lutte Contre la Sécheresse dans le Sahel</i> (Interstate Committee to Combat Drought in the Sahel)
CNRA	<i>Centre National de Recherches Agronomiques</i> (National Agricultural Research Center)
CRSPs	Collaborative Research Support Programs
DECOR	<i>Département de Recherches en Economie Rurale</i> (Department of Research in Agricultural Economics)
DG	Director General
DSI	<i>Département des Statistiques et de l'Informatique</i> (Department of Statistics and Computers)
EAPU	Experimental Agricultural Production Units
FCFA	<i>Francs de la Communauté Financière Africaine</i> (Central African francs)
FLD	<i>Fonds Européen de Développement</i> (European Common Market Fund)
FSI	Foreign Service Institute
FSR	Farming Systems Research
FSSP	Farming Systems Support Project
GNP	Gross National Product
GON	Government of Niger
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IFDC	International Fertilizer Development Center
IITA	International Institute for Tropical Agriculture
ILCA	International Livestock Center for Africa
INRAN	<i>Institut National de Recherches Agronomiques du Niger</i> (National Agricultural Research Institute of Niger)
INTSORMIL	International Sorghum/Millet Research
IRAT	<i>Institut de Recherches Agronomiques Tropicales</i> (Institute for Tropical Agricultural Research)
LOP	Life of Project
MDR	<i>Ministère du Développement Rural</i> (Ministry of Rural Development)
MESR	<i>Ministère de l'Enseignement Supérieur et de la Recherche</i> (Ministry of Higher Education and Research)
MOA	Ministry of Agriculture
NAARP	Niger Applied Agricultural Research Project
NCRP	Niger Cereals Research Project
OFR	On-farm research
ONAHA	<i>Office National des Aménagement Hydro-agricoles</i> (National Office for Hydro-agricultural Development)
PACD	Project Activity Completion Date
PM	Person-months
SAFGRAD	Semi-Arid Food Grain and Development
TA	Technical Assistance
TROPISOILS	Tropical Soils Collaborative Research Program
WARDA	West African Rice Development Association

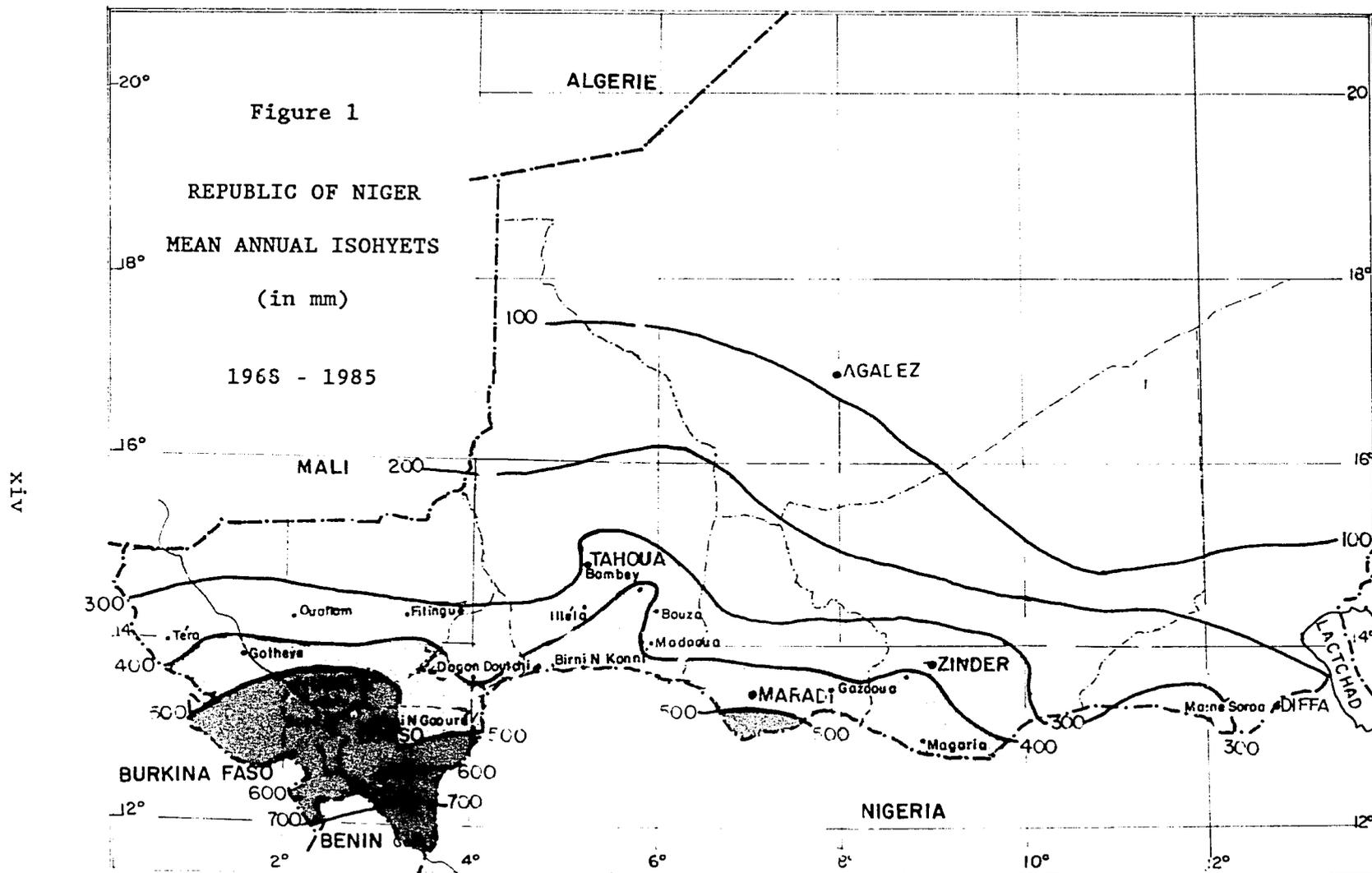


Figure 1. Map of The Republic of Niger with isohyets denoting mean annual rainfall (mm) for different regions from 1968-1985.

# INTRODUCTION

In 1981, Purdue University was selected by USAID-Niamey, Niger, to design and implement an institution-building project to be conducted in a collaborative assistance mode with the Government of Niger (GON), the *Institut National de Recherches Agronomiques du Niger* (INRAN), and USAID. A five-person design team was dispatched in mid-1981 from Purdue to Niger to undertake analysis of INRAN and its current status as a research organization and to design the Niger Cereals Research Project (NCRP).

## BACKGROUND

Niger is located in West Africa, and is composed of 490,000 square miles, much of which receives an annual rainfall of less than 200 mm, most of which falls from June through September. In general, the country is about one-third grassland savanna and two-thirds desert and mountains. Agricultural production is mainly confined to the southern regions of the country where annual rainfall averages 400-700 mm (Figure 1). Niger's overall soil resources are moderately poor and of inherently low fertility.

Forty-four percent of Niger's Gross National Product (GNP) is generated by agricultural products, mainly millet, sorghum, cowpeas, beans, peanuts, cotton and rice. Of the work force of approximately 2.5 million, 90% derive their income from agriculture. The GNP per capita (1985) was U.S. \$265.

Prior to 1974, agricultural research in Niger was directed by French institutions and was oriented on a regional West African basis, rather than being tailored to specific Nigerien needs. In 1974, the GON established INRAN as the national organization responsible for giving scientific and technical support to the problems of rural development and planning and for carrying out research in different branches of agriculture. The goal of the GON at the time was self-sufficiency in food grains, and it was considered a national priority.

Nigerien staff, with little or no experience in research, planning and management, found it difficult to meet the goal(s) of the GON because of the lack of means by which program objectives were to be met.

The principal and largest agricultural research station in the INRAN organization, the *Centre National de Recherches Agronomiques* (CNRA), is located at Tarna, near Maradi (Figure 1), 420 miles east of Niamey by paved road. Established by the French, the station was nationalized as part of the INRAN organization in 1975. CNRA is sited on two locations, a main block of 260 hectares with another 10 hectares five kilometers to the south.

The Kolo Research Station is the other INRAN agronomic research station in Niger. Located along the Niger River, it is 30 km southwest of Niamey (Figure 1), about 30 minutes by paved road. Kolo Station is the only independent crop research station in Niger other than Tarna.

A substation is located at Ouallam approximately 90 km north of Niamey. It was established in 1978 and is under the direction of the Kolo station. It comprises 60 hectares of land with physical improvements and field equipment.

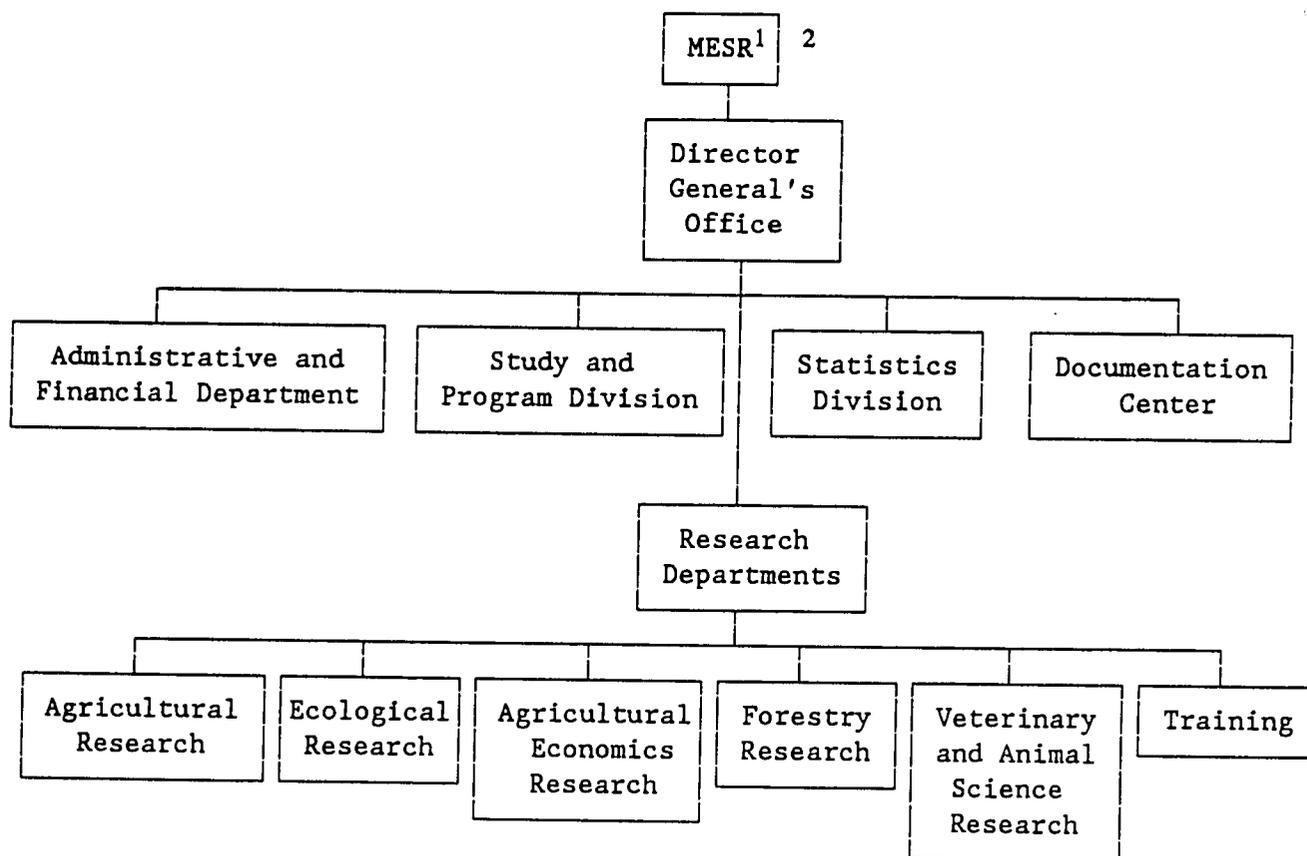
In addition, there are seven *points d'appui* (field support stations) located in various regions of the country.

In 1979, there were ten research laboratories established and an eleventh, the laboratory of plant physiology, planned. The ten included plant genetics, plant pathology, crop protection, agronomy and biological control at Maradi and soil physics, soil chemistry, oils, seeds, and irrigation and drainage at Niamey.

Between 1976 and 1980, USAID funded the Niger Cereals Project to assist the GON in alleviating some of the problems experienced by INRAN staff in development of a significant agricultural research effort. This project made a substantial contribution to the research capability by upgrading research facilities at Tarna and Kolo and training the research staff. Although scientifically-sound research was conducted during this phase, very little progress was made in integration of the research into technological packages to be delivered to the Nigerien farmers.

Figure 2 presents an organizational chart of INRAN as it existed in 1982. INRAN was administered at that time by the Ministry of Higher Education and Research (MESR), later as a part of the Ministry of Rural Development (MDR) and finally in 1985 as a unit of the Ministry of Agriculture (MOA).

Figure 2. Organization Chart of the National Agricultural Research Institute of Niger (INRAN), 1982



\*\* Stations - CNRA<sup>3</sup>, Kolo, etc. 4  
 \*\* Substations - Ouallam  
 \*\* Substation annexes - Magari, Kawara, etc.

<sup>1</sup>Ministry of Higher Education and Research

<sup>2</sup>In 1985 INRAN was moved administratively from MESR to the Ministry of Agriculture (MOA)

<sup>3</sup>CNRA: National Agricultural Research Center

<sup>4</sup>Relations to research departments are not formally determined, although stations tend to be associated with specific research departments.

Table 1. Nigerien Personnel, Professional Classification and Assignment to Scientific Units of INRAN, 1980

Scientific Unit <sup>1</sup>	<u>Professional Categories</u>					Total
	Ph.D.	Agronomist	Technician	Clerk	Field Assistant	
Management	1	3	—	4	64	72
CNRA Station	—	6	17	2	105	130
Kolo Station	—	1	6	—	66	73
DRE	—	4	7	—	51	62
DRVZ	3	1	8	—	59	71
DRF	—	—	4	—	30	34
DECOR	—	—	1	—	3	4
DSI	—	—	—	—	7	7
Fruit Section	—	—	2	—	39	41
Rice Section	—	—	5	—	28	33
Ouallam	—	—	1	—	19	20
Agadez	—	—	1	—	8	9
Bengou	—	—	1	—	23	24
Tillabéry and Lossa	—	—	2	—	45	47
Total	4	15	55	6	547	627

<sup>1</sup> CNRA: National Agricultural Research Center  
DRE: Department of Ecological Research  
DRVZ: Department of Veterinary and Animal Science Research  
DRF: Department of Forestry Research  
DECOR: Department of Agricultural Economics Research  
DSI: Department of Statistics and Computer Science Research

# PROJECT GOALS

At the time that Purdue University was in the process of designing NCRP, INRAN faced a number of constraints to its ability to provide meaningful research results to the agricultural sector. First, INRAN had not been able to obtain sufficient quantities of several critical resources, particularly scientific manpower. Table 1 is a summary of existing INRAN personnel in September 1980. It is clearly evident that the organization was severely handicapped by the lack of trained scientific manpower. In addition, many of INRAN's research staff were burdened with administrative responsibilities which detracted from their research efforts. Secondly, INRAN was not always able to effectively mobilize available resources in a number of critical areas. For example, scientists were not always sufficiently supported in their research activities with reliable laboratory analyses, statistical services, library and other information sources, etc. In addition, a substantial amount of time was consumed by scientific personnel in administrative activities. Thirdly, insufficient interdisciplinary efforts existed among scientific disciplines. The fourth constraint was that INRAN had not focused its efforts sufficiently on production research adapted to site-specific ecological environments in which agricultural production was practiced. The diversity of the environment, i.e., rainfall zones and soil types of the cultivated regions, was not taken into account in the design of INRAN research programs. Obviously, these constraints on agronomic research had profound implications on Niger's extension program.

Assistance to INRAN under NCRP was therefore oriented to enable the organization to modify and expand its programs to ensure greater interdisciplinary cooperation, more effective use of its resources in meeting research needs, development of relevant technology for various site-specific factors, and the facilitation of dissemination of research output.

The design of the new project envisioned a permanent strengthening of the capacity of INRAN to provide the sustained flow of research findings required to increase Nigerien agricultural productivity. This was to be accomplished through a host country contract between INRAN, the GON and Purdue University, and with financial support by USAID, working collaboratively to alleviate the constraints described above.

This strategy, emphasized in the Project Paper, envisioned three principal outputs of the project:

- (1) growth and development of INRAN's capacity to administer and manage its research program, its resources, and its linkages with other institutions, including those outside of Niger, e.g., Collaborative Research Support Programs (CRSPs), International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), India, International Institute for Tropical Agriculture (IITA), Nigeria, Semi-Arid Food Grain and Development (SAFGRAD), and others.
- (2) growth and development of INRAN's ability to support its researchers' efforts through service functions, e.g., expansion of library

facilities, capacity for soil analysis, food grain quality analysis, data handling and statistical analysis capability, as well as others.

- (3) the growth and development of specific research activities oriented around a comprehensive, integrated and systematic approach to research. Three specific research programs were incorporated into the project design: an interdisciplinary program of commodity research, a production systems research program, and a farming systems research program.

# PROJECT IMPLEMENTATION

In November 1982, Purdue University, with Alabama A&M University as a sub-contractor, signed a host country contract with the GON and INRAN to provide technical assistance to INRAN through NCRP. Funding for the project was provided by a grant from USAID to the GON.

Under the terms of the contract, Purdue University and Alabama A&M University were to provide a five-member team consisting of a team leader, a plant breeder, one junior and one senior agricultural economist, and a production agronomist. By the end of November 1982, Dr. John Clark, plant breeder, arrived in Niger and, in addition to his research obligations, assumed the duties of acting team leader. Local staff were hired, and Project office space provided by INRAN was remodeled and furnished. Project houses were leased in Niamey and Maradi in anticipation of the arrival of the balance of the team, a number of whom had already been nominated and approved by INRAN. Dr. Clark, in collaboration with INRAN, developed initial research plans for plant breeding trials at Maradi and Kolo, and a research reference collection of sorghum, millet and cowpeas was begun.

Before the end of 1983, the balance of the Niger team was in place: Dr. Roy Bronson, Team Leader, and Dr. Robert Deuson, Senior Economist, Purdue University faculty; Mr. Scott Swinton, Junior Economist, under contract to Purdue; and Dr. Chandra Reddy, Agronomist, Alabama A&M University faculty.

In addition to professional team assignments, the NCR Project authorized the position(s) of Research Associate. These positions were staffed by Purdue graduate students who had completed all requirements for advanced degrees with the exception of thesis research. This research was to be conducted in Niger in collaboration with Nigeriens on relevant problems of on-going project research.

The team was divided by locale so that the team leader, plant breeder, and senior agricultural economist were posted with INRAN at Project Headquarters in Niamey. The agronomist and junior agricultural economist were posted in Maradi, and the research associates were assigned to the region most appropriate to the conduct of their thesis research; in all cases, Niamey.

As a result of a recommendation made in the mid-term evaluation of the project and by amendment to the contract, a second agronomist position was added to the project in 1986. The agronomist stationed in Maradi moved to Niamey, and the second agronomist was stationed at Maradi. This ensured that agronomists were on-site both at Tarna, the principal research station near Maradi, and at Kolo, close to Niamey and the second most important research station.

Over the Life of the Project, seven individuals served as long-term staff, and three Purdue graduate students were assigned as long-term Research Associates, for a total of 25.25 person-years. Table 2 summarizes long-term staff participation, length of assignments, and the positions held during their tenure.

Purdue was to provide 53 person-months of short-term technical assistance. NCR Project-supported short-term assistance was provided by 16 individuals (1.3 person-years) representing various agricultural disciplines, as well as computer science, library science, participant training, and research management. Table 3 summarizes short-term staff participation with respect to length of stay and area of expertise.

In addition to providing field staff, Purdue University and Alabama A&M University maintained campus-based backstopping administrative staffs charged with procurement and shipping of commodities, travel arrangements for short- and long-term technical assistants, maintenance of project fiscal records, preparation of technical reports, processing trainees and assigning them to university programs, and other similar tasks essential to the success of the field operations and satisfaction of project objectives. Table 4 provides data concerning administrative visits to Niger by U.S. Project personnel responsible for administration of the Project by Purdue and its subcontractor, Alabama A&M. Table 5 provides a list of campus administrative staff and their tenure during the Life of Project.

Table 2. Long-Term Personnel

Name	Inclusive Dates		Person-years	Field/Assignment
Clark, John	28-Nov-82	07-Nov-88	6.0	Interim Chief of Party/Plant Breeder/Chief of Party
Swinton, Scott	07-May-83	07-May-86	3.0	Junior Agricultural Economist
Bronson, Roy	10-Jan-84	14-Jan-86	2.0	Chief of Party
Deuson, Robert	14-Feb-84	13-Feb-87	3.0	Senior Agricultural Economist
Reddy, Chandra	10-Mar-84	29-Feb-88	3.9	Agronomist
Kitch, Laurie	13-Apr-84	12-Apr-86	1.9	Research Associate
Krause, Mark	20-Apr-86	18-Feb-88	1.9	Junior Agricultural Economist
Hess, Dale	29-Jun-86	08-Feb-88	1.7	Research Associate
Shapiro, Barry	07-Oct-86	04-Feb-88	1.3	Research Associate
Berrada, Abdelfettah	02-Nov-86	05-Feb-88	1.3	Agronomist
Total person-years			26.0	

Table 3. Short-Term Personnel

Name	Inclusive Dates of Visit		Person- Weeks	Purpose of Visit
Deuson, Robert	02-Oct-83	16-Oct-83	2.0	Farming systems research
			2.0	
Shade, Richard	28-Sep-84	19-Oct-84	3.0	Bruchid-resistant cowpea research
Saunders, Stewart	03-Oct-84	18-Nov-84	6.6	Library science
			9.6	
Malczynski, Len <sup>1</sup>	10-Dec-84	21-Dec-84	1.6	Computer installation
Malczynski, Len	14-Feb-85	21-Apr-85	9.4	Training/computer installation
Wiley, Robert	27-Aug-85	04-Sep-85	1.1	Intercropping research
Sanders, John	16-Sep-85	09-Oct-85	3.3	Farming systems research
Cocanougher, Robert	25-Sep-85	22-Nov-85	8.3	Computer training/ documentation
			23.7	
McLaughlin, Jeannette <sup>2</sup>	20-Feb-86	28-Mar-86	5.1	Sorghum cereal quality
McLaughlin, Jeannette	02-May-86	10-May-86	1.1	Sorghum cereal quality
Murdock, Christopher	20-May-86	28-Jun-86	5.6	Bulk white seed potato storage
Housley, Tom	01-Aug-86	17-Aug-86	2.3	<i>Striga</i> resistance
Harms, Charles	15-Aug-86	01-Sep-86	2.4	Phosphorus nutrition
Shade, Richard	12-Sep-86	26-Sep-86	2.0	Bruchid-resistant cowpea research
			18.5	
Jones, Don	15-May-87	30-May-87	2.1	Expert Systems
Deuson, Robert	15-May-87	30-May-87	2.1	Expert Systems
Johnson, Glenn	16-May-87	26-May-87	1.4	Research management
Gibson, Harry	18-May-87	30-May-87	1.7	Expert Systems
Kirleis, Allen	13-Sep-87	25-Sep-87	1.7	Food quality
Kahler, David	15-Jan-88	07-Feb-88	3.3	Training
			12.4	
	Total person-weeks		66.3	
	Total person-years		1.3	

<sup>1</sup>1.6 person-weeks on Purdue University campus

<sup>2</sup>1.1 person-weeks on Purdue University campus

Table 4. Administrative Visits

Name	Inclusive Dates of Visit		Person-Weeks	On-Campus Responsibility
Sapra, V.T.	09-Apr-81	19-Apr-81	1.4	NCRP Campus Coordinator (Alabama)
Brown, C.B.	04-Dec-82	18-Dec-82	2.0	NCRP Campus Coordinator
Cherry, J.H.	04-Dec-82	09-Dec-82	0.7	Professor, Horticulture
Collom, J.L.	14-Mar-83	24-Mar-83	1.4	Associate Director, International Programs in Agriculture
Liska, B.J.	05-Sep-83	07-Sep-83	0.3	Dean of Agriculture
Phillips, M.W.	05-Sep-83	07-Sep-83	0.3	Head, Agronomy Department
Dobson, W.D.	05-Sep-83	07-Sep-83	0.3	Head, Agricultural Economics Department
Collom, J.L.	10-Jan-84	19-Jan-84	1.3	Associate Director, International Programs in Agriculture
Collom, J.L.	09-Mar-84	29-Mar-84	2.9	Associate Director, International Programs in Agriculture
Brown, C.B.	15-Jul-84	21-Jul-84	0.9	NCRP Campus Coordinator
Collom, J.L.	30-Sep-84	11-Oct-84	1.6	Associate Director, International Programs in Agriculture
Collom, J.L.	07-Apr-85	29-Apr-85	3.1	Associate Director, International Programs in Agriculture
Brown, C.B.	26-Apr-85	19-Jun-85	7.7	NCRP Campus Coordinator
Okezie, B.O.	19-Aug-85	02-Sep-85	2.0	Director, International Programs (Alabama A&M)
Collom, J.L.	06-Sep-85	29-Sep-85	3.3	Associate Director, International Programs in Agriculture
Menacher, J.P.	20-Sep-85	09-Oct-85	2.7	Contract officer-Purdue
Coleman, J.E.	17-Nov-85	16-Dec-85	4.1	NCRP Administrative Assistant
Oyer, A.M.	17-Mar-86	16-Apr-86	4.3	Training coordinator
Thomas, D.W.	17-Oct-86	01-Nov-86	2.1	Director, International Programs in Agriculture
Thomas, D.W.	04-Jan-88	09-Jan-88	0.7	Director, International Programs in Agriculture
	Total Person-Weeks		41.7	
	Person-Months		10.8	
MacKay, S.	Private visit; not financed by project funds			Language Training Coordinator, Purdue University

Table 5. On-Campus Administrative Staff  
Over the Life of the Project

Name/Position	University	Dates of Service
Project Director:		
James Collom	Purdue University	Nov. 1982 - Nov. 1986
Woods Thomas	Purdue University	Nov. 1986 - Nov. 1988
Onuma Okezie	Alabama A&M University	Sept. 1983 - Nov. 1988
Campus Coordinator:		
Cyril Brown	Purdue University	Nov. 1982 - June 1985
James Collom	Purdue University	July 1985 - Nov. 1986
Woods Thomas	Purdue University	Nov. 1986 - Nov. 1988
Val Sapra	Alabama A&M University	Sept. 1983 - Nov. 1988
Administrative Assistant:		
Carol Dullaghan	Purdue University	Nov. 1982 - Nov. 1983
Janice Coleman	Purdue University	Nov. 1983 - Nov. 1988
Elaine Fails	Alabama A&M University	Sept. 1983 - Nov. 1988
Training Coordinator:		
June Lang	Purdue University	Nov. 1982 - June 1984
Kim Irwin	Purdue University	July 1984 - July 1985
Ann Oyer	Purdue University	July 1985 - Nov. 1987
Elaine Fails	Alabama A&M Univ.	Sept. 1983 - Nov. 1987

Nigerien scientists and administrators benefitted greatly from consultancies other than NCRP-funded short-term technical assistants, such as those supported through linkages with Collaborative Research Projects (CRSPs), e.g., INTSORMIL (International Sorghum/Millet Research) and TROPSOILS (Tropical Soils Collaborative Research Program). Other consultants were funded through the USAID Program Support Grant and the CILSS (Interstate Committee to Combat Drought in the Sahel). These researchers, their sponsoring organizations, and the purpose of their visits are presented in Appendix 1.

U.S. institution-based administrative support activities consisted of the Purdue NCRP Advisory Committee and the Purdue-Alabama A&M Inter-University Advisory Council. The former originated during the first year of the project and consisted of administrators responsible for Purdue policy decisions concerning the project. The Committee met on an "as-needed" basis to monitor, evaluate, and provide overall policy and direction to Purdue's participation in the project. The Committee included the Director of International Programs in Agriculture, the Project Campus Coordinator, and Heads of the Departments of Agronomy, Agricultural Economics, Entomology, and Horticulture, as well as the Director of the Agricultural Experiment Station and the INTSORMIL Niger Country Coordinator.

The Inter-University Council was created in 1984 and met biannually. Its responsibilities included examining the progress of the project and providing evaluation/recommendations to render the best management scheme, bearing in mind the major project objective of institution building of INRAN. Members of the Council were the Directors of International Programs, NCRP Campus Coordinators, and a representative named by the President of each university.

In-country project administration was enhanced by forming four committees which were responsible for making recommendations, based on a consensus of both INRAN and NCRP committee members, concerning specific problems facing INRAN. Each committee was chaired by a senior Nigerien scientist, and in addition to Nigerien members, a minimum of two NCRP team members also served on the committees. Nigerien advisors to the committees were included as part of the structure. With the exception of the NCRP team members, members were appointed by the Director General of INRAN. The four committees were:

- (1) Committee on Commodity Purchase and Management
- (2) Committee on Long- and Short-Term Training
- (3) Committee on Library and Documentation
- (4) Committee on Short-Term Assignments

Such structure involved more senior staff in administrative matters and spread responsibility over a broader range of personnel, thus better familiarizing them with the process of project management. The latter two committees were combined to form a single committee in 1985.

# PROJECT ACHIEVEMENTS

## PARTICIPANT TRAINING

It was evident from analyses of INRAN and its available scientific manpower that there existed a critical shortage of trained scientists to conduct agricultural research and contribute to the Government of Niger and INRAN's long-term goal of food self-sufficiency.

As a result, the NCRP design team proposed academic training programs for 20 Nigeriens over the initial five-year period leading to B.S., M.S. or Ph.D. degrees. The goal was to provide a minimum of scientific manpower in disciplines identified as having critical shortages.

In addition, 30 man-months of specialized short-term training were included in the project design to enhance the technical expertise of existing Nigerien scientific manpower.

In total, Purdue University disbursed nearly one and a half million dollars for training programs and their management during the period from November 1982 until November 1, 1987. At that point in time, the Office of International Cooperation and Development of the United States Department of Agriculture assumed responsibility for the training programs initiated by NCRP.

## LONG-TERM TRAINING

Candidates for advanced-degree training were selected by the GON and the USAID Mission prior to the implementation of NCRP in 1982. Not all of the students were fully prepared for matriculation in United States universities. However, Purdue was able to make suitable arrangements to overcome shortcomings in prior training of the candidates, and all entered institutions of higher education in the U.S.

Immediate entry into educational programs in U.S. institutions was not permitted until each candidate had demonstrated English proficiency. All were placed in English training, most at the American Language Institute in Washington, D.C. Their progress was monitored by the Training Officer of the Office of International Programs in Agriculture at Purdue.

At the end of the first year of the NCRP, four Nigerien students had been provisionally placed at Purdue University and three at Alabama A&M University, first as non-degree students, and later as degree candidates. The remaining students continued in English training prior to assignment to a university.

After year one of the project, a selection process for advanced-degree candidates was deemed necessary because:

- The contractor, Purdue University, had no input in the selection process;
- None of the candidates could demonstrate acceptable English proficiency at the time of selection;
- Candidates were not selected for discipline areas in which there was a critical shortage of trained scientists.

During year two of the project, the NCRP Committee on Long- and Short-Term Training recommended and agreed upon changes in the selection process:

- The selection process would involve each of the NCRP partners.
- Candidates would demonstrate English proficiency while in Niger;
- Candidates would be placed in training in areas of critical shortage.

Appendix 2 summarizes long-term academic training for Nigerien students sponsored by NCRP. Twenty-two Nigeriens received training which was administered by shared responsibility between Purdue and Alabama A&M Universities.

Of the twenty-two degree objective students trained, 18 completed the requirements for the Bachelor of Science degree, and seven continued in a Master of Science program and have completed the required course of study. In addition, two students completed programs leading to the Ph.D. Two of the students nominated for training terminated their plans of study without obtaining a degree.

The results of long-term training programs are reflected in the data concerning INRAN personnel. In 1980, INRAN personnel totaled 622, of whom 74 were classified either as researchers (19) or technicians (55). By 1987, there were fewer personnel (535), of whom 26 were classified researchers and 66 were agricultural technicians. This net increase in the number of researchers and supporting technicians was the result of training programs instituted under NCRP.

## SHORT-TERM TRAINING

### Specialized Training

During the life of the project, 44 person-months (PM) were devoted to a variety of specialized short-term training programs. INRAN staff involvement was interdisciplinary, as was specialized training. Sixteen of the programs (22.5 PM) involved professional training in the United States, while the remaining 21 programs totaling 21.5 PM were conducted in third countries.

The specialized training programs were diverse in approach: short courses, the NCRP Annual Workshops as well as other workshops held in the U.S. and third world countries, observational visits, and professional meetings. Subject matter covered in these programs included extension training, farming systems

research, statistics, computer technology, project administration, soil science, fertilizer, irrigation technology, commodity breeding and agronomic research.

In addition to the U.S. universities taking part in the training programs, a number of International Agricultural Research Centers provided training experience for INRAN researchers. In addition to IITA, ICRISAT, and International Livestock Center for Africa (ILCA), Ethiopia, tropical agricultural research groups such as West African Rice Development Association (WARDA), SAFGRAD, International Fertilizer Development Center (IFDC) and The Farming Systems Support Project (FSSP) were involved in short-term training.

Third country training took place in Benin, Burkina Faso, Ethiopia, Côte d'Ivoire, India, Italy, Mali, Morocco, Nigeria, Tunisia, and Zimbabwe.

A summary of short-term training is presented in Appendix 3.

### In-Country Training

An important aspect of institution building is informal in-country training provided by expatriate staff during the normal course of business and research with their INRAN counterparts. A good example of such interaction was hands-on computer training through several training sessions organized by Adam Abdoulaye, Head of *Département des Statistiques et de l'Informatique* (DSI), and project consultant, Mr. Len Malczynski. After the training session, NCRP staff worked with INRAN researchers training mid-level cadres at Tarna in the use of database management and spreadsheet software for analysis of farm surveys.

Likewise, Niamey staff were trained in the use of BTOS, MULTIPLAN, and MSTAT software. Concurrently, terms of reference were established by Dr. Robert Deuson for advanced training of staff of the *Département de Recherches en Economie Rurale* (DECOR) in the use of spreadsheets, and text processing instruction was conducted by a Peace Corps volunteer, Mr. Jerry Smith.

A second important part of NCRP training was in-service improvement of technical skills of Nigerien staff. This was targeted for two distinct groups: field personnel and researchers. The latter were assisted in improving their analytical and technical writing skills.

In addition, on-the-job training was provided Nigerien students studying in vocational agricultural schools at the University of Niamey or abroad. These students had the opportunity to work for three months with researchers in the field on practical problems.

Seminars by short-term consultants were another means which kept INRAN staff abreast of recent research results and developments. Topics such as intercropping, linear programming, and bruchid beetle resistance in cowpeas are a few examples of the type of programs presented.

## RESEARCH PROGRAMS

Technical analysis of the ability of INRAN to adequately carry out the duties with which they were charged indicated the desirability of developing a three-pronged research effort as mentioned above, i.e. (1) multi-disciplinary commodity research, (2) cereals production systems research, and (3) farming systems research. Implied in this design was a team approach to problem solving, rather than the classical organization and operation within individual disciplines. The same research objectives - namely the improvement of production of a specific commodity - are sought by each of the research disciplines (crop improvement, agronomy, economics, crop protection, etc.) brought together to work in a systems approach to problem solving.

Programmatically, the three research areas were integrated; thus, considerable multidisciplinary research activity was introduced to INRAN, but much improvement can still be realized in institutionalizing such interdisciplinary research.

### COMMODITY RESEARCH

The primary research objective of this program was the development of improved, acceptable, agronomically and nutritionally superior varieties which provided potential productivity of the crops under investigation, namely sorghum, millet, and cowpeas. This infers that new lines, varieties, or hybrids will be evaluated in various agro-ecological zones.

Sorghum is considered the second most important cereal suitable for consumption, and the development of this crop occupies an important place in the campaign undertaken by Niger for food self-sufficiency.

#### The Sorghum Improvement Program

INRAN used a balanced approach in objectives, as well as selection techniques and genetic material used. Through solicitation and local variety collections, local germplasm was manipulated. Some exotic germplasm was also introduced from other African countries, the U.S., and international organizations (ICRISAT). This genetic material was evaluated through observational and yield trials, and the best cultivars were used as varieties or lines, or even incorporated into the breeding program. Evidence of the importance of exchanging genetic material and experiments with other institutions is convincing.

#### The Sorghum Breeding Program

This program consisted of mass selection for the preservation and improvement of existing varieties and pedigree selection, plus improvement of populations to develop new lines. At the same time, there was an effort to develop hybrids which were to provide zones of highly fertile and irrigated perimeters with highly productive hybrids. This latter effort was relatively short-term and could, through additional research, result in adapted hybrids ready to be extended to farmers in the next five years. Pedigree selection was

intended to produce new lines within 8-10 years. Population improvement is more long-term, encompassing 10-15 years before it results in new lines.

The breeding program was especially oriented toward sorghums destined for valley soils which are fertile and more productive, recognizing that millet and dune sorghum are more adapted for dune soils. Nevertheless, dune soils were largely used for testing local introduced varieties adapted to various stresses.

The main sorghum breeding objectives in Niger were:

- Obtaining high-yielding stable material
- Obtaining short and medium cycle material (according to different ecological zones)
- Improving grain quality from a taste as well as a nutritional point of view
- Resistance to drought, insects and diseases.

Finally, the program developed varieties for different ecological regions of Niger, taking into account local farmers' preferences.

The sorghum improvement program during 1983-1987 was based on the following:

- Maintenance of the existing material
- Collection and study of local varieties
- Introduction and study of exotic varieties
- Study of hybrid vigor and the ability to combine, produce and experiment with hybrids
- Development and breeding of new lines.

The program was executed by the implementation of varietal trials on INRAN stations and substations (Tarron, Kolo, Bengou, Lossa, Tillabéry, Konni, Magaria and Diffa) and also in farmers' fields by means of multilocational trials. Breeding work was done at Tarna, Kolo, and, on a lesser scale, at Bengou.

These objectives were ambitious. They necessitated not only the constant attention of INRAN sorghum breeders and technicians, but also close collaboration with researchers in plant protection, cereal quality, general agronomy, physiology, soil science and agricultural economics. Success of this research program required strong administrative support from the Director General's office, technical departments, and research stations.

#### CEREALS PRODUCTION SYSTEMS RESEARCH

The production systems research program concentrated on the development of agronomically-sound production practices in systems designed specifically to suit the various agro-ecological zones of Niger. Such systems were tested at locations other than experiment stations to better evaluate their potential for increased productivity. The result of this research effort was the development of specifically tailored technical packages.

Three major institutional inadequacies within the agronomy program were identified early in the implementation of the project and were brought to the

attention of INRAN administration. These shortcomings were (a) the lack of trained manpower (mentioned above), (b) inappropriate development of recommendations for farmers, i.e., broad recommendations for diverse agro-ecological zones and (c) an isolated agronomy department with no regular institutional mechanism for understanding production constraints.

Each of these three major identified inadequacies was largely overcome by INRAN during NCRP years.

(a) The problem of inadequate manpower was amply addressed within the INRAN administrator's power. In 1985, after the mid-term evaluation of NCRP, USAID and INRAN agreed to add a second agronomist position to the NCRP. This was the only post added to the project during its execution. Similarly, the first two Nigerien returnees from the U.S. after long term-training under NCRP were attached to the agronomy program.

Basic crop production research equipment was installed both at CNRA and Kolo research stations. Some of the important acquisitions were three neutron probes, three leaf area meters (one table top and two portable), one automatic weather station, seven solarimeters, two grinding mills, four ovens, several electronic balances, etc.

(b) Since 1984, agronomic trials have been conducted in all the major agro-climatic zones of Niger to generate site-specific technologies. The first set of recommendations from these data was published in the form of a bulletin for the use of extension specialists. INRAN administration's acceptance and support to publish this bulletin can be considered as an important indication of their acceptance for generating and promoting site-specific recommendations.

(c) On-farm research (OFR) was initiated, and the agronomy program established an institutional linkage with farmers of the major recommendation domains of Niger to understand their production constraints. The concept of OFR was introduced as part of the Farming Systems Research (FSR) program by NCRP economists.

#### On-Station Research

Principal dryland crops in Niger in order of importance are millet, cowpeas, sorghum, and groundnuts. These crops are primarily cultivated in intercrop systems.

Because of the paucity of data prior to 1983 concerning intercropping of cowpeas and millet in Niger, research was initiated which concentrated on such factors as plant populations, planting geometry, varieties, fertilizer effects, pests, crop behavior, resource sharing by associated crops and yield stability. Other studies were designed to determine the effects of water conservation methods, animal traction, soil fertility, planting dates and other aspects of crop production.

### On-Farm Research (OFR)

Using a classical FSR approach, a multidisciplinary team of agronomists and agricultural economists was organized to conduct a rapid reconnaissance survey of farmers in the Filingué region of Niger where DECOR had been demonstrating improved agronomic practices (through demonstrations) for a number of years. This was the first organized multidisciplinary approach implemented by INRAN for analysis of the impact of recommended new technologies.

This survey, based on questions asked of farmers of the region, showed that they were interested in intercropping systems. The farmers also pointed out that (a) the utilization of a planting row marker and (b) the INRAN recommended methods of fertilizer application were unacceptable because they were too time-consuming. These studies served as a basis for the design of future experiments.

OFR experiments were designed by the expatriate team and their INRAN counterparts, and took into consideration all of the farmers' comments based on the results of the surveys. As a result, OFR emphasized the millet/cowpea intercropping systems. Specific problems were identified by farmers, and studies were initiated on farmers' fields to address issues raised during the reconnaissance survey.

### Farmer-Managed Trials

The principal on-farm research activity of INRAN was millet/cowpea intercropping systems. Contrary to the traditional technical package demonstrations, this on-farm experiment contained a series of alternate solutions with inputs arranged in step-wise increments. The technologies included were non-monetary inputs such as varieties, planting geometry, and plant density, and monetary inputs such as fertilizer and insecticide application. The experimental design permitted the separation of the effect of each of these factors. This experiment was conducted in 1985, 1986 and 1987 in three major recommendation domains of Niger by INRAN and the Maradi Rural Development Project. On an average, 100 farmers collaborated in conducting this trial under their own management, with some help from field observers.

### Researcher-Managed Trials

The other minor experiments conducted on farmers' fields were (1) dwarf millet performance in pure and intercrop systems, (2) comparison of different fertilizer application methods, (3) comparison of different insecticide spraying equipment, and (4) evaluation of varietal resistance against the earhead miner. These four researcher-managed experiments were initiated in collaboration with different subject matter specialists, particularly the economists. Each of the experiments has provided valuable technical information and helped to involve different Nigerien scientists in OFR.

### Multilocational Trials

Testing improved cultivars of major crops under varying climatic conditions with INRAN and extension service management on farmers' fields was often

considered in Niger as a symbol of collaboration between the research and extension agencies and also the symbol of INRAN intervention on farmers' fields.

In spite of these important institutional aims, these tests never achieved their objectives of providing information to INRAN on varietal stability and adaptability and to the extension service as a tool of demonstration of improved agronomic practices.

To improve the reliability of the results, these trials were simplified in 1985. The original split-plot design with fertilizer and variety factors was changed to randomized block design with variety as the only factor of the test. In 1987, a one-week training course on installation and follow-up procedures of agronomic trials was given to the extension agents supervising these trials. A manual was edited by Dr. C. Reddy, Mr. Abdoulaye Bonkoula and Dr. A. Berrada in the French language on these aspects. The program is presently oriented to serve INRAN breeders as a tool for collecting adaptability information on new cultivars.

#### FARMING SYSTEMS RESEARCH

Early in the implementation of NCRP, there were two main research programs under way at DECOR: (1) the Experimental Agricultural Production Units (EAPU) in the District of Filingué, and (2) the determination of recommendation domains in the District of Madarounfa. Upon his arrival in Niger, the Project Senior Economist initiated additional programs with colleagues including:

- (1) A comparative study of irrigated agriculture (rice and off-season crops) and dry-land crops (millet, sorghum, and cowpeas) along the Niger River in the Department of Niamey.
- (2) An inventory of agricultural resources and the outline for a description of farms in the Departments of Niamey and Maradi.
- (3) A collection of on-farm trials of millet and cowpea cultivation technologies in the DECOR intervention zones, i.e., Kolo, Kouka, and Madarounfa.
- (4) On-farm, dry season trials of new varieties of sorghum developed as adapted by sorghum breeders from INRAN.
- (5) A weekly study of input and output markets in the villages in the DECOR intervention zones or neighboring zones.

#### Comparative Study of Irrigated Agriculture

The NCRP did not mandate farming systems research on irrigated crops. However, it appeared evident that FSR could not ignore the importance of irrigated crops to the total agricultural systems of the Department of Niamey. In fact, more than 90% of the farmers living near the Niger River devote as much effort to the cultivation of irrigated crops as of dry-land crops.

A detailed survey was initiated in the rainy season (July-September) of 1984, and 58 farms in six villages located in three irrigation perimeters were studied. These surveys continued until the end of the 1985-86 dry season, encompassing a period of two rainy and three dry seasons.

## Inventory of Agricultural Resources

The base survey mentioned above resulted in a detailed description of the 58 sample farms and an inventory of their agricultural resources.

A similar study was conducted in the Department of Maradi where 75 farms were inventoried. The contrast between the two departments (Niamey and Maradi) was quite striking. The majority of the cropping systems in the Department of Niamey consists of millet/cowpeas intercropped and irrigated rice as a monoculture, whereas in the Department of Maradi, 37 cropping systems were identified. Such results provide evidence for the utilization of FSR recommendation domains rather than technical packages recommended for wide-scale in-country distribution.

These agricultural resource inventories and outlines of farm profiles constituted the first step in farming systems research in Niger.

The on-farm trials provided the cornerstone of the INRAN farming systems research program. Since 1984, INRAN has accepted and applied the concept of recommendations domains. This concept is put into practice by dividing productive agricultural regions of the country using accepted criteria such as agro-climatology, soils, ecology, access to economic resources, etc. to provide recommendations which are more appropriate to the specific conditions confronted in a given area.

## LINKAGES

### NATIONAL

INRAN-NCRP maintained linkages with the Agricultural Service, Ministry of Agriculture, Niger, in the conduct of multilocational varietal trials, and the Maradi and Niamey Development Projects which collaborated with the NCRP Agronomy program in studying cereal crop varieties and their response to nutritional levels.

Other linkages involved the University of Niamey, and the *Office National des Aménagement Hydro-agricoles* (ONAHA).

### INTERNATIONAL

The number of international linkages between INRAN, NCRP, and agricultural research organizations steadily increased from the beginning of the project until its completion date, and the cooperative role between the institutions took on a variety of relationships.

Of major importance was the collaborative research program developed between INRAN and the International Sorghum and Millet (INTSORMIL) Title XII Collaborative Research Support Program (CRSP). INTSORMIL and the Government of Niger signed a formal agreement to conduct collaborative research as a part of the CRSP, and Dr. John Axtell, Department of Agronomy, Purdue University, served as the INTSORMIL-Niger country coordinator.

Appendix 1 summarizes the participation of short-term consultants who were supported by INTSORMIL and who were involved with INRAN in collaborative research projects.

Logistical support of INTSORMIL-INRAN collaborative work was provided by the INTSORMIL administrative office at Purdue. Through an agreement between INTSORMIL and Purdue University, logistical support also included an in-country administrative assistant to handle backstopping of short-term consultants while they were in Niger. NCRP staff at Niamey and Maradi added additional logistical support.

NCRP team members participated in annual INTSORMIL workshops, one of which was held in Niamey in October 1984. Team members presented results of agronomic, economic, and crop improvement research at these workshops.

In addition, the Tropical Soils Collaborative Research Program (TROPSOILS) played an active role in collaborative research with INRAN and NCRP personnel. TROPSOILS maintained two soil scientists in Niger under an agreement between INRAN and Texas A&M University. A cooperative agreement between Texas A&M University and Purdue University provided logistical support of these personnel in Niger.

Linkages with other international organizations such as the International Institute of Tropical Agriculture (IITA), International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), and International Fertilizer Development Center (IFDC) involved active research participation between NCRP researchers and these organizations, as well as exchange of germplasm for breeding programs for cowpeas, sorghum and millet, and training opportunities for INRAN staff.

Other important linkages which were maintained with international organizations were with the Farming Systems Support Project (FSSP) of the University of Florida, *Projet Lutte Intégrée*, sponsored by the *Comité Permanent Inter-états de Lutte contre la Sécheresse dans le Sahel* (CILSS), AID and FAO, the European Common Market Fund (FED), and the Agro-Meteorological-Hydrology Data Collection and Forecasting Center in the Sahel, Niger (AGRHYMET). Many other collaborative efforts were undertaken to a lesser degree, but were no less important in emphasizing the changes implemented in the collaborative research made after 1982 which have benefitted all of the partners involved.

## COMMODITIES AND PHYSICAL FACILITIES

### COMMODITIES

During the life of NCRP, the Project Coordinating Office at Purdue University was responsible for the procurement of a large variety of items and their transport to the project sites in Niger. Commodities which were purchased by the Purdue office ranged from staff household furnishings to farm tractors and included computer hardware and software as well as scientific instrumentation. During the life of the project, the Purdue office purchased and shipped more than a half million dollars worth of commodities.

In 1983, the Director General of INRAN approved the formation of a Committee on Commodity Purchase and Management which was composed of six members of the INRAN professional staff (including Directors of the Kolo and Tarna Research stations and the Director of the Cereal Quality Laboratory), as well as two members of the expatriate team. Two other INRAN staff served as advisors to the committee. This Committee received equipment and supply requests from the various divisions of INRAN and recommended to the Director General and the Purdue Chief of Party a prioritized list of commodities. Expert opinions regarding acquisitions were sought from appropriate staff at either Purdue or Alabama A&M. Lists of approved items were forwarded to the Purdue Coordination Office for purchase and subsequent shipment to Niger.

A major investment was made in the purchase of computer hardware and software and its installation for INRAN. Initially (1984), the project purchased a Burroughs B-25 multi-unit system and associated software. This system was judged adequate for project needs, was capable of expansion, repair services were available in Niamey and the system was compatible with others in-country, including the IBM system at the USAID Mission. Additional hardware and software capability was added to the system during the life of project.

#### CONSTRUCTION

As a part of strengthening INRAN's capability as a research organization, it was judged appropriate and necessary by the project design team to remodel some existing facilities and add new facilities. USAID-Niamey separately funded a number of projects as a part of NCRP.

As a part of the remodeling, the office space allocated by INRAN to the NCRP administrative offices in Niamey was remodeled in 1983. Also in the same year, space was made available and remodeled at the INRAN Soils Laboratory in Niamey to house the newly-formed Cereal Quality Section.

In 1984, construction was completed at Kolo Station. Additions consisted of a laboratory and an office building, three residences for permanent technical staff, a small seed storage facility, and a large warehouse. The Director's residence and an older storehouse were remodeled.

Construction of the new INRAN Documentation and Computer Center in Niamey was completed in 1988. Construction cost savings, supplemented by other non-allocated Project funds, enabled the construction of this facility which was not originally envisioned during Project design. This new center substantially relieves a serious constraint to housing library resources and computing facilities.

# BUDGET SUPPORT

During the Life of Project, both USAID and the Government of Niger supported NCRP, the former providing both in-country and U.S. funding of implementation, operation, and administrative management of the project.

Originally, the GON-INRAN was provided 34% of local costs by a grant from USAID, while the GON provided 21% of the estimated total project costs. However, the project was extended by increments for one year, and original estimated expenditures are no longer useful.

Table 6 summarizes U.S. expenditures (dollars) for NCRP between 1982 and 1988 and indicates the expenditures for commodities and their shipment to Niger, as well as the costs of the training program. Other costs include technical assistance, maintenance and administrative costs. INRAN expenditures for NCRP are summarized in Table 7 for the total project period and divided by major budgetary items. The table lists the expenditures in FCFA (Central African francs) and the estimated exchange rate for 1988 (300 FCFA/\$1.00). However, conversion of tabular information based on this rate of exchange is not valid because of the large changes due to dollar valuation during the project period.

Table 6. Schedule of US Expenditures (Dollars) for NCRP  
by Year and General Categories

Category	YEAR						TOTAL <sup>2</sup>
	1 11/08/82- 10/31/83	2 11/01/83- 10/31/84	3 11/01/84- 10/31/85	4 11/01/85- 10/31/86	5 11/01/86- 10/31/87	6 <sup>1</sup> 11/01/87- 11/30/88	
Commodity Purchase and Shipping	9,969.04 <sup>3</sup>	29,929.14	144,035.73	230,615.55	162,050.88	274,240.92	850,841.26
Training	136,726.84	148,412.59	202,898.00	465,086.13	255,910.46	144,787.20	1,353,821.22
All Other Costs	417,402.38	579,608.86	681,212.33	836,548.04	723,658.63	571,604.94	3,810,035.18
Total US Costs	564,098.26	757,950.59	1,027,701.01	1,532,694.77	1,141,204.96	991,048.07	6,014,697.66

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<sup>1</sup> Year six figures include an encumbrance of \$93,967 for shipping tractors and other agricultural machinery to Niger.

<sup>2</sup> Total costs through 11/30/88; total costs during LOP will reflect expenditures incurred through PACD of 6/18/89.

<sup>3</sup> Central African francs (FCFA); 300 FCFA = \$1.00 U.S.

Table 7. Schedule of Allocated In-Country Expenditures by INRAN  
by Year and General Categories

Category	YEAR						TOTAL
	1 11/08/82- 10/31/83	2 11/01/83- 10/31/84	3 11/01/84- 10/31/85	4 11/01/85- 10/31/86	5 11/01/86- 10/31/87	6 11/01/87- 11/30/88	
Personnel	6.143.485	23.695.568	58.706.000	48.275.000	62.038.000	8.585.000	207.443.053
Equipment	6.304.800	9.560.000	86.960.000	69.720.000	220.300.000	7.857.000	400.701.800
Vehicles- Freight	3.987.254	28.162.500	66.640.000	69.449.000	100.425.000	7.012.000	275.675.754
Education	10.164.000	11.630.000	6.870.000	2.330.000	26.237.000	696.000	57.927.000
<b>TOTAL</b>	<b>26.599.539</b>	<b>73.048.068</b>	<b>219.176.000</b>	<b>189.774.000</b>	<b>409.000.000</b>	<b>24.150.000</b>	<b>941.747.607</b>

## PROBLEM AREAS AND RECOMMENDATIONS

The acquisition of long-term personnel with appropriate technical skills and the required French language fluency (U.S. State Department, Foreign Service Institute [FSI] S-3, R-3) in addition to willingness to contract for long-term overseas assignment was a problem for NCRP. Thus in some cases, posts remained vacant for a period which was overall deleterious to the project and its institutional missions.

An appropriate solution to this problem would be identifying persons with necessary technical skills and willingness to be involved with long-term overseas assignments and enrolling them in intensive FSI language training until they achieve a rating required for development projects. An alternative would be training in France or other Francophone countries to acquire the required skills.

A second problem encountered by NCRP was delayed reimbursement by USAID which continued periodically during the life of project. Deficits sometimes ran high, e.g., \$450,000 in 1986, and had the net effect of stopping all progress in purchasing of commodities, etc. This can be resolved by timely monthly funding of reimbursements and/or forward funding for 60-day "tranches".

The needs for additional trained personnel are documented and should be considered in the future development of INRAN training programs to strengthen the Institute. However, a system for personnel management should be initiated whereby researchers and assistants are classified by experience and meritorious service rather than the length of time as a civil service employee. This infers a system of merit increases through a hierarchy of ranks, and in which incentives are developed for promotion within the cadre of professional personnel.

NCRP initiated some changes in management, but additional effort is needed to provide fiscal responsibility and productive programs. In general, INRAN management staff should take every opportunity to become aware of modern management techniques to provide sound fiscal management as well as decentralized management responsibilities. This involves not only business management practices, but also research and research program planning, including determination of research priorities.

Identification and dissemination of research results need to be improved through linkage between INRAN and Nigerien extension organizations to better inform the agricultural clientele of new technologies which are available. This can be enhanced through publication of a variety of materials, as well as by radio and other systems of telecommunication.

Research programs should broaden their scope to include irrigated as well as rainfed crops, thus considering a wider range of crops and the removal of productivity constraints.

Maintenance or addition of established linkages with International Agricultural Research Centers and other international agricultural organizations should be encouraged at the institutional and research program level.

Better use could have been made of available short-term technical assistance to aid in program development and institution building. Only 25% of the time (53 person-months) originally allocated for short-term consultancies was utilized in supporting NCRP research and development activities. Any follow-on activity in support of INRAN should make adequate use of short-term technical assistance.

NCRP has made a significant impact on the ability of INRAN as an institution to alleviate agricultural production constraints in Niger. Reinforcing INRAN so that the institution grows even stronger is a further step towards providing Niger with the necessary organization to continue on the path towards agricultural self-sufficiency.

## **APPENDICES**

APPENDIX 1  
 MISCELLANEOUS VISITS TO PROJECT BY RESEARCHERS SUPPORTED BY  
 INTSORMIL AND TITLE XII PROGRAM SUPPORT GRANTS

Name	Inclusive Dates of Visit		Person- Weeks	Sponsoring Organization
Axtell, John	27-Feb-83	06-Mar-83	1.0	INTSORMIL/INTSORMIL research planning
Gilstrap, Frank	31-Jul-83	08-Aug-83	1.3	INTSORMIL/Biological control of pests
			2.3	
Ejeta, Gebisa	19-Apr-84	05-May-84	2.3	INTSORMIL/Sorghum breeding
Mason, Stephen	04-Jun-84	20-Jun-84	2.3	PSG/Sorghum stand establishment
Abbott, Phil	07-Jul-84	19-Jul-84	1.7	INTSORMIL/Ag sector policy
Teetes, George	26-Sep-84	10-Oct-84	2.0	INTSORMIL/Pest control
Ejeta, Gebisa	28-Sep-84	08-Oct-84	1.4	INTSORMIL/Sorghum breeding
Zumo, Natalie	14-Oct-84	21-Oct-84	1.0	INTSORMIL/Grain diseases
			10.7	
Andrews, David	01-Mar-85	08-Mar-85	1.0	INTSORMIL/Breeding program
Baber, Willy	01-Jul-85	01-Aug-85	4.0	PSG/Anthropological inputs to Farming Systems Research
			5.0	
Youm, Ousmane	28-May-86	16-Dec-86	28.9	INTSORMIL/Biological control of pests
Tyler, Tom	06-Jun-86	11-Dec-86	26.9	INTSORMIL/Sorghum hybrid search
Ejeta, Gebisa	23-Jun-86	07-Jul-86	2.0	INTSORMIL/Sorghum harvest & search
Adesina, Akin	01-Jul-86	11-Aug-86	5.7	INTSORMIL/Whole farm modeling
Eastin, Jerry	14-Jul-86	28-Jul-86	2.0	INTSORMIL/Intercropping
Steck, Gary	15-Jul-86	01-Nov-86	15.6	INTSORMIL/Headbug control
Pratt, Richard	12-Sep-86	26-Sep-86	2.0	INTSORMIL/Bruchid-resistant cowpea research
Axtell, John	21-Sep-86	01-Oct-86	1.4	INTSORMIL/sorghum research; prep. for ext. eval. review
Teetes, George	28-Sep-86	06-Oct-86	1.1	INTSORMIL/headbug research
Axtell, John	13-Oct-86	22-Oct-86	1.3	INTSORMIL/External evaluation panel review
Sanders, John	16-Oct-86	30-Oct-86	2.0	INTSORMIL/External evaluation panel review
			89.9	

Name	Inclusive Dates of Visit		Person- Weeks	Sponsoring Organization
Mason, Steve	25-May-87	04-Jun-87	1.4	INTSORMIL/intercropping legume w/millet under stress cond.
Verma, Paresh	27-May-87	04-Nov-87	23.0	INTSORMIL/crop physiology
Youm, Ousmane	17-Jun-87	13-Dec-87	25.6	INTSORMIL/millet spike borers
Axtell, John	27-Jun-87	08-Jul-87	1.6	INTSORMIL/INTSORMIL proposal development
Eastin, Jerry	30-Jun-87	14-Jul-87	2.0	INTSORMIL/Sorghum physiology
Frederiksen, Richard	23-Aug-87	30-Aug-87	1.0	INTSORMIL/Long smut inoculation screening
Hilu, Omar	23-Aug-87	30-Aug-87	1.0	INTSORMIL/Long smut inoculation screening
Stegmeier, William	28-Sep-87	04-Oct-87	.09	INTSORMIL/Millet breeding
Maranville, Jerry	07-Oct-87	22-Oct-87	2.1	INTSORMIL/Physiology program
Ejeta, Gebisa	18-Oct-87	30-Oct-87	1.7	INTSORMIL/Sorghum breeding
Frederiksen, Richard	28-Oct-87	30-Oct-87	.06	INTSORMIL/Long smut problem
			59.6	
Total Person-Weeks			167.5	
Total Person-Years			2.7	

APPENDIX 2  
LONG-TERM TRAINING PROGRAMS (1982-1988)

Name	University	Degree Objective and Discipline	Date of Completion
Abdou Kadi-Kadi, Hame	Texas A&M	BS - Entomology	8/90
Aboubacar, Adam	Kansas State	BS - Food Science	5/89
Bio, Maman Dodo	Purdue	BS - Statistics	8/89
Boulama, Mahamane	Univ. of Wis.	BS - Rural Sociology	5/90
Hama, Boukary	Miss. State	BS - Seed Technology	12/86
Mahamadou, Ibrahim	Miss. State	BS - Seed Technology	12/87
Mossi, Kadidia	Univ. of Neb.	BS - Plant Physiology	5/89
Raphiou, El Ibrahim	N. Carolina St.	BS - Agronomy (Weed Science)	5/89
Sirifi, Seyni	Purdue	BS - Agronomy	9/86
Alou, Abdourhamane	Univ. of Ariz.	BS/MS - Agronomy (Soils)	12/89
Amadou, Diallo	Univ. of Ariz.	BS/MS - Agronomy (Soils)	12/89
Cherif-Ari, Oumarou	Purdue	BS/MS - Agronomy (Striga)	12/87
Gandah, Mohamadou	Texas A&M	MS - Agronomy (Soils)	3/88
Issoufou-Kollo, Abdourhamane	Purdue	BS/MS - Botany (Plant Path.)	5/88
Kapran, Issoufou	Purdue	BS/MS - Agronomy (Plant Breed.)	5/88
Mahaman, Bachir	Purdue	BS/MS - Agronomy (Soils)	12/87
Mahaman, Issaka	Purdue	BS/MS - Agronomy (Soils)	5/88
Sabiou, Mahamane	Univ. of Ariz.	BS/MS - Agronomy (General)	5/89
Adamou, Moussa	Miss. State	PhD - Agronomy (Plant Breed.)	12/89
Ouattara, Mamadou	Texas A&M	PhD - Agronomy (Soils)	12/89
Coulibaly, Ibrahim	Purdue	Program Incomplete	
Harouna, Kouassi	Santa Fe Comm. College	Program Incomplete	

## APPENDIX 3

## U.S. AND THIRD COUNTRY SHORT-TERM TRAINING PROGRAMS

NAME	TYPE OF TRAINING	TRAINING LOCATION	PERSON MONTHS
Adam Abdoulaye Ly Samba	Observational Visit to SAFGRAD/FSU Project	Ouagoudougou, Burkina Faso	.50
Adam Abdoulaye	Statistics Course Computer Software	Washington, D.C.	1.25
Ly Samba	West African Association of Ag. Economics Meetings	Abdijan, Côte d'Ivoire	.25
Ouendeba Botorou Moussa Adamou	Observational Visit (Breeding Experiments)	IITA Ibadan, Nigeria Mali & Burkina Faso	.50
Moussa Oumarou	Laboratory Work on Cereal Quality	Purdue University Texas A&M Kansas State IDRC, Canada	2.00
Adam Abdoulaye	Statistics Seminar Computer Software Training	Washington, D.C. Purdue University Stanford University	2.25
Ly Samba	Farming Systems Research Symposium	Kansas State University Purdue University	.75
Goubé Moussa Gaoh	Fertilizer Efficiency Research in the Tropics Conference	IFDC Bamako, Mali	.25
Mamadou Ouattara	Administrative Visit	Purdue University	.25
Moussa Oumarou	Regional Sorghum Workshop	ICRISAT Ouagadougou, Burkina Faso	.25
Goubé Moussa Gaoh Jada Gandah	Observational Visit (Millet & Sorghum Production Systems)	ICRISAT Hyderabad, India	1.00
Moutari Maman Moussa Hama Boureima Chabiou Sodé	Management, Methodology Instrumentation & Techniques for Mineral Analysis of Soils & Plants Shortcourse	IITA Ibadan, Nigeria	3.00

NAME	TYPE OF TRAINING	TRAINING LOCATION	PERSON MONTHS
Goube Moussa Gaoh	Development Indigenous Phosphate Shortcourse	IFDC Muscle Shoals, AL	.75
Abdoulaye Bonkoula	West Africa Rice Dev. Association Meetings	WARDA Abidjan, Côte d'Ivoire	.25
Ouendeba Botorou Jika Neino	Observational Visit (Millet harvest)	ICRISAT Hyderabad, India	.50
Goubé Moussa Gaoh	Farming Systems Research Symposium	Kansas State Univ. Purdue University	.25
Hama Hassane	Regional Workshop on Sorghum Improvement	ICRISAT Bamako, Mali	.25
Soumaila Oumarou Elhadji Moumouni	Research & Production of Soybeans & Cowpeas Shortcourse	IITA Ibadan, Nigeria	4.00
Mahamane Issa	Land Management Workshop Phase	University of Harare Zimbabwe	1.00
Moussa Oumarou	International Conference on Millet	ICRISAT Hyderabad, India	.75
Idrissa Soumana Toukoua Daouda	Administrative Visit	Purdue, University of Nebraska, Alabama A&M University	1.50
Chetima Mai-Moussa	On-Farm Irrigation, Design, Evaluation, & Scheduling Conference	Utah State University Logan, Utah	1.75
Moumouni Ouesseini	Agriculture Extension Shortcourse	Univ. of Wisconsin (USDA)	2.50
Abdoulaye Adam	Statistics Courses & Computer Training	Univ. of Michigan, Purdue, Burroughs-Paris	4.0
Issoufou Tiemoko	<i>Traitement et Diffusion de l'Information Agricole</i> Conference	ILCA Addis Ababa, Ethiopia	.25
Mahaman Issa	Land Management Workshop Phase II	University of Harare Zimbabwe	1.00

NAME	TYPE OF TRAINING	TRAINING LOCATION	PERSON MONTHS
Mai-Moussa Chetima	On Farm Water Management Course	Int'l Irrigation Center, Utah State, Rabat, Morocco	1.00
Maliki Kadi	"Farming Systems Research & Extension: Food and Feed" Symposium	Kansas State University	.25
Illia Habou Moussa Djibo	Workshop on Research & Production Techniques Applied to Cowpeas & Soybeans	IITA Cotonou, Benin	2.50
Maliki Kadi	FSSP Regional FSR/E Training Course	FSSP-Univ. of Florida Bamako, Mali	1.00
Daouda Tanimou Seidi Idrissa	Seed Technology Shortcourse	IITA Ibadan, Nigeria	1.50
Iddi Ousmane Sanoussi Garba	Burroughs Computer Training	Gamma Conseils Tunis, Tunisia	2.50
Ouendeba Botorou	Millet Breeding Tour of U.S. Universities	Purdue Univ., Tifton, Georgia Exp. Station, Kansas State Univ., Univ. of Nebraska	.75
Issaka Magah	NCRP Annual Workshop	Alabama A&M Univ., Purdue University	.50
Moussa Gaoh	Statistical & Economical Analysis of Fertilizer Experimental Data	IFDC Muscle Shoals, AL	1.75
Toukoua Daouda	<i>Quatrième Consultation Techniques des Centres</i> CARIS	CARIS Rome, Italy	.25
Mahaman Issa	Farming Systems Research Symposium, October 18-20, 1987 Research Work under John Sanders, Ag. Econ. Dept., Oct. 21-Nov. 17, 1987	University of Arkansas Fayetteville, AK Purdue University West Lafayette, IN Bamako, Mali	1.00

#### SHORT-TERM TRAINING SUMMARY

U.S. Based Training: 16 programs, 22.50 person-months  
 Third Country Training: 21 programs, 21.50 person-months

APPENDIX 4  
PUBLICATIONS AND PRESENTATIONS

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Publications

- Abdoulaye, A. et A. Berrada. 1988. Les principes de l'expérimentation au champ (Principles of field experimentation), p. 5-15. In: Reddy, K.C., A. Berrada, et A. Bonkoula (ed.). 1988. *Manuel de l'expérimentation en plein champ à l'usage des cadres de développement agricole*. INRAN, BP 429, Niamey, Niger.
- Adamou, née Rabi Oumarou. 1986. Evaluation agro-économique de quatre variétés de sorgho sur le périmètre irrigué de Konni. Mémoire de fin d'études. Ecole Nationale Supérieure d'Agronomie de Rennes, Chaire d'Economie Rurale. Institut National de Recherches Agronomiques du Niger. Département de Recherches en Economie Rurale.
- Adamou, M. et J.W. Clark. 1985. Amélioration du sorgho. Résultats de l'hivernage 1984. INRAN, BP 429, Niamey, Niger.
- Adamou, M. et J.W. Clark. 1986. Amélioration du sorgho. Résultats de l'hivernage 1985. INRAN, BP 429, Niamey, Niger.
- Adamou, M. et J.W. Clark. 1986. Importance et amélioration du sorgho au Niger. In: *Niger Sorghum and Millet Workshop, Report of Research Collaboration in Niger*, J.D. Axtell and J.W. Clark, eds. Purdue University, West Lafayette, Indiana. Sponsored by INRAN, INTSORMIL, and PARA. Held October 13-17, 1985, at Niamey, Niger.
- Berrada, A. et al. 1987. Rapport de la Mission du 7 au 14 Septembre dans les départements de Zinder et Diffa. Institut National de Recherches Agronomiques du Niger, Niamey, Niger.
- Berrada, A. et al. 1987. Situation des essais multilocaux du 15 septembre 1987 dans les départements de Maradi, Diffa, Tahoua et Zinder. Institut National de Recherches Agronomiques du Niger, Niamey, Niger.
- Berrada, A. et M. Kadi. 1987. Rapport de la mission à l'Institut de Recherches Agricoles de Zaria, 24-28 août 1987. Institut National de Recherches Agronomiques du Niger, Niamey, Niger.
- Berrada, A., S. Sirifi, and C.K. Reddy. 1987. Résultats des essais multilocaux pour la campagne 1986. Institut National de Recherches Agronomiques du Niger, Niamey, Niger.
- Berrada, A. 1987. Rapport de la Section Agronomie Générale-CNRA pour la campagne 1986 (1986 Annual Technical Report for the General Agronomy Division at CNRA). Presented at INRAN annual meetings at Matameye, May 4-10, 1987. INRAN-CNRA, Maradi, Niger. 20 p.

- Berrada, A. et S. Sirifi. 1987. Rapport de la réunion des chercheurs et collaborateurs en Agronomie Générale à Niamey, 21-23 février 1987 (Report of the agronomy meeting in Niamey, February 21-23, 1987). INRAN-CNRA, Maradi, Niger. 61 p.
- Berrada, A. 1988. Rapport provisoire de la campagne 1987 (Preliminary report of the 1987 crop season). INRAN-CNRA, Maradi, Niger. 38 p.
- Berrada, A. et S. Sirifi. 1987. Installation et conduite des essais au champ (Installation and Management of Field Trials). In: Reddy, K.C., A. Berrada, and A. Bonkoula (ed.). 1988. *Manuel de l'expérimentation en plein champ à l'usage des cadres de développement agricole*. INRAN, BP 429, Niamey, Niger. pp 17-30.
- Berrada, A., J. Gonda, and S. Sirifi. 1988. Yield Advantage of Millet/Groundnut Intercropping in Niger. Presented at the International Conference on Dryland Farming, August 15-19, 1988, at Amarillo/Bushland, Texas.
- Chantereau, C. et M. Adamou. 1987. Principaux résultats et orientation sur le sorgho au Niger. *Agronomie Tropicale* XXXII-3.
- Clark, J.W. and M. Adamou. 1983. Trip Report to Sorghum Breeding Programs in Upper Volta, Niamey, Niger, 1983.
- Clark, J.W. and J. Van der ploeg. 1985. Compte rendu sur la visite de l'aménagement de l'ONAHA à Dambou, Niamey, Niger, January 1985.
- Clark, J.W. 1987. Programme amélioration du sorgho. Rapport annuel de la campagne hivernale 1986. INRAN, BP 429, Niamey, Niger.
- Clark, J.W. 1987. Méthodes de criblage utilisées dans le programme d'amélioration de sorgho de l'INRAN pour les infestations du charbon allongé. *La Recherche Agronomique*, Revue de l'Institut National de Recherche Agronomiques du Niger No. 1. INRAN, BP 429, Niamey, Niger.
- Clark, J.W. 1988. Programme amélioration du sorgho. Rapport annuel de la campagne hivernale 1987. INRAN, BP 429, Niamey, Niger.
- Clark, J.W. and Ahmadou N'Diaye. 1987. Trip Report to ICRISAT Burkina-Faso Sorghum Field Tour September 30-October 3, 1987. Institut National de Recherches Agronomiques du Niger, Niamey, Niger.
- Clark, J.W., M. Adamou, S. Soumana, J. Gonda, A. Mounkaila, I. Magah, et G. Abel. 1988. Observations critiques sur les cultures. Chapter VIII. In: Reddy, K.C., A. Berrada, et A. Bonkoula (ed.). 1988. *Manuel de l'expérimentation en plein champ*. INRAN, BP 429, Niamey, Niger.
- Clark, J.W. and I. Kapran. 1988. Synthèse de cinq années (1983-1987) de la recherche du programme amélioration du sorgho. Presented at the INRAN Annual Meeting in Maradi, Sept. 1988.

- Cocanougher, Robert. 1985. Final report - Purdue University TDY. International Programs in Agriculture, Purdue University, West Lafayette, Indiana.
- Deuson, Robert, Don Jones, Harry Gibson, and Adam Abdoulaye. 1987. Temporary Duty Assignment Report: Workshop on Expert Systems Applications in Agriculture. International Programs in Agriculture, Purdue University, West Lafayette, Indiana.
- Gaoh, G., K.C. Reddy, and B. Ahmadou. 1988. Les éléments nutritifs. Chapter IV. In: *Manuel de l'expérimentation en plein champ*. INRAN, BP 429, Niamey, Niger.
- Harms, Charles. 1986. Report on Consultation Trip with INRAN, Niamey, Niger. International Programs in Agriculture, Purdue University, West Lafayette, Indiana.
- Hassane, H. 1986. Situation actuelle de la recherche en pathologie végétale au Niger. In: *Niger Sorghum and Millet Workshop, Report of Research Collaboration in Niger*, J.D. Axtell and J.W. Clark, eds. Purdue University, West Lafayette, Indiana. Sponsored by INRAN, INTSORMIL, and PARA. Held October 13-17, 1985, at Niamey, Niger.
- Hess, D.E. 1985. Heritability and Mechanisms of Resistance to *Striga hermonthica* in Sorghum. Research plan prepared for: Program Support Grant, NCRP, International Programs in Agriculture, Purdue University.
- Hess, D.E. 1987. Programme de sélection pour la résistance au *Striga*. Report presented at the annual meeting of INRAN, Matameye, Niger, May 4-10, 1987.
- Hess, D.E. and G. Ejeta. 1987. Effect of Cultural Treatments on Infection of *Striga hermonthica* (Del.) Benth, (Scrophulariaceae) on sorghum in Niger. In: *Parasitic Flowering Plants (Proceeding of the 4th ISFPF, Marburg, 1987)*. Weber, and Forestreuter, W. (eds.), pp. 367-375.
- INRAN. 1984. Section laboratoire oleagineux/mycotoxines/qualité céréalière. Rapport d'activité. INRAN, BP 429, Niamey, Niger.
- Issa, M., K. Maliki, A. Berrada, R. Deuson, G. Ibro, M. Krause, K.G. Numa, K.C. Reddy, and B. Shapiro. 1987. Evaluation des essais en milieu réel sur les cultures associées mil-niébé: Résultats de la campagne 1986 (Evaluation of Millet/Cowpea On-farm Trials: 1986 Results). Document #17F. INRAN/DECOR-DRA, BP 429, Niamey, Niger. Also to be published: Results of the 1987 Millet/Cowpea On-farm Trials.
- Jika, N. et B. Ouendeba. 1986. Programme de sélection du mil au Niger. In: *Niger Sorghum and Millet Workshop, Report of Research Collaboration in Niger*, J.D. Axtell and J.W. Clark, eds. Purdue University, West Lafayette, Indiana. Sponsored by INTSORMIL, INRAN, and PARA. Held October 13-17, 1985, at Niamey, Niger.

- Jika, N., G. Jada et B. Ouendeba. 1988. Programme développement de la culture du mil. Bilan des cinq dernières années de recherche en matière de sélection et perspectives d'avenir. INRAN, BP 429, Niamey, Niger.
- Johnson, Glenn L. 1986. Doing and Administering Agricultural Research: Some Essential Elements. International Programs in Agriculture, Purdue University, West Lafayette, Indiana. (French edition published as *La conduite et l'administration de la recherche agricole: quelques éléments essentiels.*)
- Kapran, I. 1987. Evaluation of the Agronomic Performance and Food Quality Characteristics of Experimental Sorghum Hybrids in Niger, West Africa. M.S. Thesis, Purdue University, West Lafayette, Indiana. 135 p.
- Kapran, I., M. Adamou and J.W. Clark. 1988. Results and Perspectives of Sorghum Improvement in Niger. In: *Proceedings of Regional Workshop on Sorghum Improvement in West and Central Africa*, 20-23 Sept., 1988. Maroua, Cameroon. (in press).
- Kennedy, L., S. Ly, and R. Deuson. March 1985. A Case Study of On-Farm Trials in the Kolo District in 1984. (French edition published as: *Rapport de recherche étude des cas portant sur des essais en milieu réel effectués dans l'arrondissement de Kolo, en 1984.*)
- Kirleis, A.W. et B. Hamaker. 1986. Digestibility of sorghum proteins. In: *Niger Sorghum and Millet Workshop, Report of Research Collaboration in Niger*, J.D. Axtell and J.W. Clark, eds. Purdue University, West Lafayette, Indiana. Sponsored by INTSORMIL, INRAN, and PARA. Held October 13-17, 1985, at Niamey, Niger.
- Kitch, Laurie W. 1987. *Relationship of Bruchid (Callosobruchus Maculatus) Resistance Genes in Three Cowpea Cultivars.* Ph.D. Thesis, Purdue University, West Lafayette, Indiana. 60 p.
- Ly, S. and R. Deuson. Mars 1985. Profil de trois aménagements du fleuve Niger et inventaire préliminaire des ressources de 58 exploitations-échantillons.
- Ly, S. et R. Deuson, Mars 1985. Résultats préliminaires de la campagne céréalière de 1984 dans six villages-échantillons repartis sur trois aménagements du fleuve Niger.
- Ly, S., R. Deuson, K.C. Reddy, M. Kadi, and G. Numa. 1986. Evaluation des essais en milieu réel sur les cultures associées mil-niébé: résultats de la campagne de 1985 (Evaluation of On-farm Trials of Millet-cowpea Cropping Systems: Results from the 1985 Season). In: *Selected Bibliographic Readings in Farming Systems*. PN-AAV-949. USAID and Kansas State University, Manhattan, Kansas. 108 p.

- Ly, S., R. Deuson et S. Swinton. 1986. Situation actuelle de la recherche socio-économique de l'Institut National de Recherches Agronomiques du Niger. In: *Niger Sorghum and Millet Workshop, Report of Research Collaboration in Niger*, J.D. Axtell and J.W. Clark, eds. Purdue University, West Lafayette, Indiana. Sponsored by INTSORMIL, INRAN, and PARA. October 13-17, 1985, at Niamey, Niger.
- Ly, S., G. Numa, M.G. Gaoh, K.C. Reddy, R. Deuson, and S. Swinton. 1986. The Evolution of Farming Systems Research at the National Institute of Agricultural Research of Niger. *Farming Systems Research and Extension: Management and Methodology*, Cornelia Butler Flora and Martha Tomecek, eds. Kansas State University, Manhattan, Kansas, pp. 93-110.
- Ly, S., R. Deuson, K. Malaki, G. Numa, C. Reddy et S. Swinton. 1986. Evaluation des essais en milieu réel sur les cultures associées mil-niébé: Résultats de la Campagne de 1985. Paper presented at Kansas State University's 1986 Farming Systems Research Symposium. (also published as Document No. 14F, INRAN, BP 429, Niamey, Niger)
- Maiga, S.D. 1986. Données acquises sur la mineuse de l'épi, *Raghuva albipunctella*. *Niger Sorghum and Millet Workshop, Report of Research Collaboration in Niger*, J.D. Axtell and J.W. Clark, eds. Purdue University, West Lafayette, Indiana. Sponsored by INTSORMIL, INRAN, and PARA. Held October 13-17, 1985, at Niamey, Niger.
- Mahamadou, G. and Reddy, K.C. 1985. Influence of Plant Type on the Production of Millet and Cowpea in Intercrop Systems of SAT, Niger. *Agronomy Abstracts 1985*, p. 36.
- Mahamadou, G. and Reddy, K.C. 1985. Water Use Patterns of Millet and Cowpea in Sole and Intercrop Systems in SAT, Niger. *Agronomy Abstracts 1985*, p. 36.
- Mahamadou, I.M., K.C. Reddy, Hama Hassane, et al. 1985. Rapport annuel du programme amélioration de la culture du niébé. Institut National de Recherches Agronomiques du Niger, Niamey, Niger.
- Maliki, Kadi, M. Krause and B. Shapiro. 1988. "Le Relève de Temps de Travail", Chapter X. In: Reddy, K.C., A. Berrada, et A. Bonkoula (ed.). 1988. *Manuel de l'expérimentation en plein champ à l'usage des cadres de développement agricole*. INRAN, BP 429, Niamey, Niger.
- Ouattara, M. et N. Persaud. 1986. Contraintes liées au sol et à l'eau et adaptations à ces contraintes par les paysans locaux lors de la production céréalière en culture pluviale. In: *Niger Sorghum and Millet Workshop, Report of Research Collaboration in Niger*, J.D. Axtell and J.W. Clark, eds. Purdue University, West Lafayette, Indiana. Sponsored by INTSORMIL, INRAN, and PARA. October 13-17, 1985, at Niamey, Niger.

- Oumarou, M., J.W. Clark et J. McLaughlin. 1984. The preparation and qualify of sorghum TUWO in Niger. In: *Proceedings of the ICRISAT Regional Workshop*. Ouagadougou, Burkina Faso, November 1984, p. 157-168.
- Oumarou, M., J.W. Clark, et J. McLaughlin. 1986. Programme qualité céréalière et analyse de la qualité céréalière de quatre variétés de sorgho pour la préparation du Tuwo nigérien. In: *Niger Sorghum and Millet Workshop, Report of Research Collaboration in Niger*. J.D. Axtell and J.W. Clark, eds. Purdue University, West Lafayette, Indiana. Sponsored by INTSORMIL, INRAN, and PARA. October 13-17, 1985, at Niamey, Niger.
- Oumarou, M., J.W. Clark, et J. McLaughlin. 1987. Caractéristiques morphologiques, chimiques et organoleptiques de quatre variétés de sorgho. *La Recherche Agronomique, Revue de l'Institut National de Recherche Agronomiques du Niger* No. 1. INRAN, BP 429, Niamey, Niger.
- Reddy, K.C. and G. Prine. 1984. Biological Control of Parasitic Nematodes by Crop Rotation with Selective Tropical Legumes. In: *La sécheresse en zone intertropicale pour une lutte intégrée*. Conseil international de la langue française, 103 rue de Lille - 75007, Paris. pp. 577-578.
- Reddy, K.C. 1985. Rapport de l'agronomie générale de la campagne, 1984. Institut National de Recherche Agronomique du Niger (INRAN), BP 429, Niamey, Niger. 55 p.
- Reddy, K.C. 1985. Niébé en association. In: *Le rapport annuel de programme d'amélioration de la culture du niébé, 1984*. Institut National de Recherche Agronomique de Niger (INRAN), BP 429, Niamey, Niger. pp. 62-83.
- Reddy, K.C., J. Van der ploeg, and J. Gonda. 1985. Recherche agronomique des cultures pluviale au Niger, le programme en cours et les perspectives d'avenir. In: *Niger Sorghum and Millet Workshop*. Eds. J.D. Axtell and J.W. Clark. Purdue University, West Lafayette, Indiana, USA. pp. 81-92.
- Reddy, K.C. and E.C. French. 1985. Water and N Effects on Semi-arid Tropics Cropping Systems. *Liaison Sahel* No. 13, pp. 99-108.
- Reddy, K.C., and J. Gonda. 1985. Recherche en culture associée au Niger (A Review of Intercropping Research in Niger). *Liaison Sahel* No. 3, pp. 109-125.
- Reddy, K.C., A. Oumara, and A. Timbo. 1985. Rapport de l'agronomie générale de la campagne 1984. Institut National de Recherches Agronomiques du Niger, Niamey, Niger.

- Reddy, K.C., J. Van der Ploeg et J. Gonda. 1986. Recherche agronomique des cultures pluviales au Niger: le programme en cours et les perspectives d'avenir. In: *Niger Sorghum and Millet Workshop, Report of Research Collaboration in Niger*, J.D. Axtell and J.W. Clark, eds., pp. 93-109. Purdue University, West Lafayette, Indiana. Sponsored by INTSORMIL, INRAN, and PARA. October 13-17, 1985, at Niamey, Niger.
- Reddy, K.C. 1987. Letter to the editor on the article titled Area x Time Equivalency Ratio: A Method Evaluating the Productivity of Intercrops by C.K. Hiebsch and R.E. McCollum (*Agronomy Journal* 79:15-22, 1987). *Agronomy Journal* 79:945.
- Reddy, K.C., J. Van der ploeg, I. Mahamadou, A. Berrada, S. Sirifi. 1988. Rapport de l'agronomie générale de la campagne, 1987. Institut National de Recherche Agronomique du Niger (INRAN), BP 429, Niamey, Niger.
- Reddy, K.C. 1988. *Stratégies alternatives pour la production de mil/niébé pendant l'hivernage*. Fascicule No. 1. INRAN/Purdue University, West Lafayette, Indiana.
- Reddy, K.C., A. Bonkoula, and A. Berrada, eds. 1988. *Manuel de l'expérimentation en plein champ à l'usage des cadres de développement agricole*. INRAN, BP 429, Niamey, Niger.
- Reddy, K.C. and J. Van der Ploeg. 1988. Appropriate Cowpea Plant Type for Pure and Intercrop Systems in Niger. (Under review for publication in *Field Crops Research*.)
- Reddy, K.C., J. Van der Ploeg, and I. Mohamadou. 1988. Méthodes d'estimation du rendement. Chapter IX In: Reddy, K.C., A. Berrada, et A. Bonkoula (ed.). 1988. *Manuel de l'expérimentation en plein champ à l'usage des cadres de développement agricole*. INRAN, BP 429, Niamey, Niger.
- Saunders, E.S. April 1985. Documentation Centers and Services (Short-Term Report). Purdue University, West Lafayette, Indiana. (French edition published as Rapport sur les centres et services de documentation.)
- Shapiro, B.I. and P. Jomini. 1987. "La Programmation linéaire: une technique pour l'évaluation de nouvelles technologies." *La Recherche Agronomique, Revue de l'Institut National de Recherche Agronomiques du Niger* No. 1. INRAN, BP 429, Niamey, Niger.
- Shull, Jeannette McLaughlin, Moussa Oumarou, Allen W. Kirleis, et John W. Clark. 1986. *Manuel de laboratoire pour analyses de la qualité du sorgho pour usage dans l'Afrique de l'ouest*. Purdue University, West Lafayette, Indiana. (English edition published as *Sorghum Quality Laboratory Manual for Use in West Africa*.)

- Swinton, S., A. Bagna, N. Atto, M. Assoumane. Mars 1985. *Les ressources agricoles des exploitations dans trois villages représentatifs de l'arrondissement de Madarounfa*. Institut National de Recherches Agronomiques du Niger, Niamey, Niger.
- Swinton, S., G. Numa, et S. Ly. 1985. "Les cultures associées dans deux régions du Niger: Filingué et Madarounfa." In: *Liaison Sahel*, No. 3 (June 1985), Institut du Sahel, Bamako, Mali, pp. 183-194. (Also DECOR Document No. 4.)
- Swinton, S., Abdourahamane Bagna, Manaïoua Atto et Mamane Assoumane. 1985. "Les ressources agricoles de 75 exploitations agricoles dans l'arrondissement de Madarounfa en 1984." Programme sur les Systèmes de Production Agricole. Document No. 7. INRAN, Maradi, Niger.
- Swinton, S. and S. Ly. 1986. "Defining Agricultural Recommendations Domains in South-Central Niger." In: *Selected Proceedings of Kansas State University's 1984 Farming Systems Research Symposium*, Kansas State University, Manhattan, Kansas, pp. 318-331. (Also DECOR Document No. 3.)
- Swinton, S. 1987. "Drought Survival Tactics of Subsistence Farmers in Niger." *Economic Development and Cultural Change*.
- Tyler, T.A. 1987. Heterotic Pattern and Combining Ability for Agronomic and Food Grain Quality Traits in Exotic X Exotic, Exotic X Intermediate, and Exotic X Local Sorghum Hybrids in Niger. M.S. Thesis, Purdue University, West Lafayette, Indiana, 150 p.
- Willey, R.W. November 1985. Rapport de la visite de consultant pour la révision de la recherche en cultures associées effectuée dans le cadre du programme INRAN/NCRP au Niger. Purdue University, West Lafayette, Indiana. (English edition published as Report of a Consultancy Visit to Review the Intercropping Research Being Carried out in the INRAN/Purdue/Alabama Program in Niger.)

## Presentations

- Berrada, Abdel. 1987. Le rapport agronomie générale, contre-saison, 1986. Presented at INRAN Annual Meetings held at Matameye, Niger, May 4-10, 1987.
- Deuson, R.R., K.C. Reddy, and M.A. Krause. 1987. Design, Implementation, Evaluation, and Evolution of the National Farming Systems Research of Niger. Presented at the Workshop on Farming Systems Research for Limited Resource Farms, held at Alabama A&M University, Normal, Alabama, August 10-12, 1987.
- Gonda, J. and Reddy K.C. 1986. Drought-resistant Strategies Practiced by INRAN. Presented at the SAFGRAD World Drought Conference, held at Nairobi, Kenya, May 19-22, 1986.
- Hess, Dale. 1987. Programme de sélection pour la résistance au *Striga*. Presented at INRAN Annual Meetings held at Matameye, Niger, May 4-10, 1987.
- Issa, M., M. Kadi, M. Krause, K.C. Reddy. 1987. L'évaluation des essais en milieu réel sur les cultures associées mil-nièbe: Résultats de la campagne de 1986. *Institut National de Recherches Agronomiques du Niger (INRAN)*, BP 429, Niamey, Niger.
- Kadi, M., K.C. Reddy, M. Krause, and I. Mahamane. 1987. Méthodes d'analyse des expérimentations en milieu paysan: Synthèse de deux années d'expérience des essais en milieu réel. Presented at the SAFGRAD On-farm Research Conference held at Maroua, Cameroon, September 21-23, 1987.
- Krause, M., M. Kadi, K.C. Reddy, R. Deuson, and I. Maman. 1987. The Economic and Agro-ecological Considerations for the Adoption of New Technologies by Farmers (Considérations économiques et agro-écologiques pour l'adoption des technologies nouvelles par l'exploitant). Presented at the International Workshop on Soil, Water, and Plant Improvement Systems for Rainfed Agriculture in the Sudano-Sahelian Zone held at Niamey, Niger, January 11-16, 1986.
- Krause, M., K. Maliki, K.C. Reddy, R. Deuson, and I. Maman. 1987. Effect of Labor Requirement Needs on the Profitability of New Millet/Cowpea Technologies in Niger. Presented at the Annual Farming Systems Research Meetings held at Fayetteville, Arkansas, October 18-21, 1987.
- Krause, M.A., K. Maliki, K.C. Reddy, R.R. Deuson, and I. Mahamane. 1987. Labor management effects on the relative profitability of alternative millet-cowpea intercrop systems in Niger. Presented at the Farming Systems Research Symposium held at Fayetteville, Arkansas, October 18-21, 1987.

- Ly, S., R. Deuson, et S. Swinton. Octobre 1985. Situation actuelle de la recherche socio-économique à l'Institut National de Recherches Agronomiques du Niger.
- Ly, S., R. Deuson, M.G. Gaoh, K.C. Reddy, and S. Swinton. 1985. The Evolution of Farming Systems Research at the National Agronomic Research Institute of Niger. Presented at the Annual Farming Systems Research Meetings held at Kansas State University, Manhattan, Kansas, October 14-17, 1985.
- Ly, S., R. Deuson, K. Maliki, G. Numa, K.C. Reddy, and S. Swinton. 1986. Evaluation des essais en milieu réel sur les cultures associées mil/niébé: résultats de la campagne de 1985. Presented at the Annual Farming Systems Research Symposium held at Kansas State University, Manhattan, Kansas, October 5-8, 1986.
- Mahamadou, I. and Reddy, K.C. 1985. Influence of Plant Type on the Production of Millet and Cowpea in Intercrop Systems of Semi-arid Tropics, Niger. Presented at the American Society of Agronomy Annual Meeting held at Chicago, Illinois, December 1-6, 1985.
- Mahamadou, G. and K.C. Reddy. 1985. Water Use Patterns of Millet and Cowpea in Sole and Intercrop Systems of Semi-arid Tropics, Niger. Presented at the American Society of Agronomy Annual Meeting held at Chicago, Illinois, December 1-6, 1985.
- Oumarou, M. and J.W. Clark. 1987. Etude comparée des caractères physico-chimiques de quatre variétés de sorgho et évaluation des qualités organoleptiques de leurs tuwos. Presented at the INRAN Annual Meetings held at Matameye, Niger, May 4-10, 1987.
- Reddy, K.C. 1984. A Discussion Document from DRA on FSR. Presented at INRAN-FSR Work Group Meeting 1. INRAN, BP 429, Niamey, Niger.
- Reddy, K.C. and E.C. French. 1984. Effect of Water and N on Cropping Systems in Semi-arid Tropics. Presented at the ICRISAT Regional Workshop on Intercropping in the Sahelian and Sahel-Sudanian Zones of West Africa held at Niamey, Niger, October 7-10, 1984.
- Reddy, K.C. and J. Gonda. 1984. Review of Intercropping Research in Niger. Presented at the ICRISAT Regional Workshop on Intercropping in the Sahelian and Sahel-Sudanian Zones of West Africa held at Niamey, Niger, October 7-10, 1984.
- Reddy, K.C. 1985. Millet/cowpea on-farm research proposal. Presented at INRAN annual meeting at Tarna, Niger, on March 27-April 2, 1985. INRAN, BP 429, Niamey, Niger.
- Reddy, K.C. and A. Oumara. 1985. Niébé dans les systèmes des cultures au Niger. Presented at the Seminar on Conservation of Food Legumes in Africa (organized by the University of Niamey and AUPELF), held at Niamey, Niger, November 19-22, 1985.

- Reddy, K.C., J. Van der ploeg, and J. Gonda. 1985. Agronomic Research in Niger: Current Status and Future Needs. Presented at the INTSORMIL Sorghum and Millet Workshop held at Niamey, Niger, October 14-17, 1985. (French and English)
- Reddy, K.C., S. Ly, R. Deuson, and B. Ouendeba. 1986. Tests variétaux en milieu réel. Presented at the ICRISAT Regional Pearl Millet Workshop held at Niamey, Niger, September 6-11, 1986.
- Reddy, K.C., *et al.* 1986. Drought-resistant Strategies Practiced at INRAN. Presented at the SAFGRAD World Conference on Drought held in Nairobi, Kenya, May 19-22, 1986.
- Reddy, K.C., *et al.* 1986. Rapport de la section agronomie générale de la campagne 1985. Presented at the Département Recherche Agronomique (DRA) meetings held at Tarna, Niger, February 10-14, 1986.
- Reddy, K.C. 1987. La recherche sur la culture associée à l'INRAN. Presented at the INRAN Annual Meetings held at Matameye, Niger, May 4-10, 1987.
- Reddy, K.C. 1987. Le rapport de l'agronomie générale de la campagne, 1986. Institut National de Recherche Agronomique du Niger (INRAN), BP 429, Niamey, Niger. 60p.
- Reddy, K.C. and J. Van der ploeg. 1988. Soil Conservation Methods for Clayey and Sandy Soils of Niger. Presented at the International Conference on Dryland Agriculture held at Bushland, Texas, August 15-19, 1988.
- Reddy, K.C. and I. Mahamadou. 1988. Appropriate Cropping Systems for Niger. Presented at the International Conference on Dryland Agriculture held at Bushland, Texas, August 15-19, 1988.
- Soumana, I. and K.C. Reddy. 1987. La recherche sur la culture associée au Niger. Presented at the International Workshop on Water and Natural Resources Management for Increased Crop Production in Africa (sponsored by the International Science Foundation), Niamey, Niger, March 9-14, 1987.