Midterm Evaluation of the National Cereals Research and Extension Project

Phase II (631-0052)

USAID/YAOUNDE

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July 14, 1989

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EXECUTIVE SUMMARY

Phase II of the National Cereals Research and Extension (NCRE) Project expands the USAID/Cameroon investment in applied cereals and cropping systems research, technology transfer, and institution building that began in Phase I, from 1979 to 1985 (Project 631-0013). Phase II began with project authorization, on October 10, 1984, of a grant of $35.4 million and a loan of $3.6 million. Phase II has a project actual completion date (PACD) of December 12, 1994. (In this report, the current contract period from 1984 to December 1990 is called Phase II. The period from January 1991 through December 1994 is called Phase III.) The basic problem identified by the project was the lack of agricultural-production technology adapted to Cameroon's diverse agroclimatic zones and the needs of rural smallholders.

The long-term goal of the project is to increase agricultural production and rural development by building Cameroonian institutional capacity for applied agricultural research. The purpose of Phase II is to provide additional assistance to develop the capacity of the Institute of Agronomic Research (IRA) to provide high-quality research on maize, rice, sorghum, and millet and to facilitate utilization of research results by farmers. Four liaison structures for research and extension, known as testing and liaison units (TLUs), are supported in Phase II to integrate cereals research into the cropping systems of the country's major agroecological zones in a way that focuses on the problems farmers face in food production.

PURPOSE OF THE MIDTERM EVALUATION

This evaluation fulfills the requirement of the project authorization that an independent and comprehensive evaluation of the project be conducted in fiscal year 1989. The purposes of the evaluation are to determine the extent to which major project and policy objectives have been advanced, and to recommend the extent to which the project should be continued and/or modified for fiscal years 1990 through 1994.

TEAM COMPOSITION AND STUDY METHODS

A seven-person evaluation team spent one week in preliminary meetings and review of documents. The team, accompanied by one IRA senior researcher and USAID representatives, spent three weeks in field visits to NCRE project sites. The team was presented formal briefings on project accomplishments and plans, reviewed ongoing trials, and held interviews with IRA staff and related development institutions. Two work-weeks were allocated for subsequent work with IRA, analysis of documents and collected information, and draft and final report preparation.

FACTORS AFFECTING THE NCRE PROJECT

Cameroon Economic Crisis Phase II

The project paper (PP) assumed that Cameroon's economic growth would continue unabated. The capacity of the public sector to provide expanded support of major investment and recurrent expenditures was unquestioned. The current economic crisis has radically reduced capacity of the Government of the United Republic of Cameroon (GRC) to provide recurrent cost financing for research and, more important, for financing of credit, input supply, and marketing and processing organizations, which the project design assumed would promote strong demand for improved production technologies. Oil revenues can no longer finance all activities. Agriculture has again become the sector that will have to carry the economy for the medium to the long term (see Annex E). This change has altered the research management environment. Research now must show that it can help agriculture adjust its production, postharvest storage, and marketing systems to meet an environment that is much more resource constrained.

Mistaken Design Assumptions

The first major mistaken assumption was that the World Bank Agricultural Research Support Project would be able to increase the overall research management capacity of IRA rapidly. The rate of improvement in research management and administrative capacity has not kept pace with the needs of the NCRE project or with the sudden shift in available operating budget. The second mistaken assumption was that a high level of soil analysis support would be available from existing IRA sources and donor projects. The lack of soil-testing capacity from a service-oriented laboratory has substantially reduced the efficiency of many agronomic trials, the on-farm fertilization trials, and some portions of the breeding programs.

The Special Nature of the Contractor

The International Institute of Tropical Agriculture (IITA), Ibadan, Nigeria, is the contractor for the NCRE project. IITA is the principal international center for crop-related agricultural research and development in Africa. IITA has adopted a new strategic plan and a medium-term plan, which call on IITA to reduce its institutional involvement in direct management of country outreach programs, to consolidate its commodity and agroecological mandate, and to establish regional stations in its primary agroecological zones of interest. The humid tropical forest station will be constructed in Cameroon. There are, therefore, special ties between IITA and Cameroon that go beyond the NCRE project. USAID is concerned, however, that the implementation of the new directions for IITA will make such a large call on IITA management that the NCRE project might not be accorded the priority needed to service its needs fully. USAID needs to ascertain whether the level of IITA management attention and responsiveness to the Cameroon-specific project needs can be increased, as is needed for the remainder of Phase II and for Phase III of the project. Pending that determination, USAID asked the evaluation team to examine the advantages and disadvantages of extending IITA's contract,

compared with other contracting options. A full discussion is given in Section Seven of the report and is summarized below.

CONTRACTING

USAID should include all training, construction, and procurement responsibilities in a prime contract, to redress the current lack of clear accountability for project management. The prime contractor would have the responsibility for directing the work of any subcontractors to fit the needs of the overall project work plan.

Through December 1990, the evaluation team does not believe that all procurement, training, and construction can be reallocated to the existing IITA contract without causing substantial disruption of project operations. It would, however, be feasible to put these elements into a prime contract by January 1991. IITA's continuation as prime contractor after December 1990 would permit continuity in project operations, which is extremely important for a research project. Also, IITA is the only international center with substantial project management experience in Cameroon and with the institutional commitment to Cameroon needed to ensure continuing cooperation beyond the life of project. However, significant improvements in attention to research-management issues, short-term backstopping, financial management, participant training, and procurement are needed if Phase III is to function well. Bid competition, which at least is open to Title XII institutions, would ensure that IITA undertakes a careful reexamination of its capabilities and develops a subcontracting plan and approach to managing the services needed from other international centers and research organizations. Competition would also provide USAID management with the opportunity to evaluate an IITA institutional response to the research management challenges as well as the technology challenges facing Cameroon, IRA, and the NCRE project (see Section Seven).

FINDINGS

The NCRE Phase II project has successfully built on the foundation of the Phase I effort. Key accomplishments are highlighted in the following table.

TABLE 1

NCRE ACCOMPLISHMENTS, 1985-1989

1. BREEDING: Varieties developed and released by NCRE:

Variety	Year Released	Region	Type
----------Lowland Maize----------			
CMS 8501	1985	North & SE	Medium, White, OP
CMS 8503	1985	Center & North	Medium, White, OP
CMS 8602	1986	North	Early, Yellow, OP
CMS 8704	1987	Center & North	Medium, Yellow,OP
DMR-ESR-Y	1988	Center	Early, Yellow, OP
CMS 8710	TBR	North	Late, White, OP
NDOCK 8701	TBR	Center	Late, White, OP
----------Highland Maize----------			
SHABA	1986	Adamoua	Late, White, OP
KASAI	1985	West & NW	Short, White, OP
COCA SR	TBR	West & NW	Late, White, OP
BACOA SR	TBR	West & NW	Early, Yellow, OP
----------Rice----------			
IR 7167	1986	Ndop Plain	Irrigated
CICA 8	1984	Mbo Plain	Irrigated
BKN 3033	1987	Agrilagdo	Irrigated
ITA 222	TBR	Agrilagdo	Irrigated
----------Sorghum----------			
S35	1985	E. North	Early, White
CS54	1988	E. North	Early, White
CS95	1988	North	Medium, White
CS61	1988	North	Medium, White
S34	1986	North	Medium, White

TBR = to be released
OP = open pollinated

2. AGRONOMY: Technologies researched and being extended to growers:

- The use of minimum and no tillage on the fragile alfisols in the North Province. This recommendation has resulted in a significant reduction in soil erosion caused by excessive disc plowing in land preparation.

- The use of "Marshal" as a seed treatment for maize and sorghum. This recommendation has resulted in significantly greater seedling establishment and higher yields than that obtained with former seed treatments.

3. TESTING AND LIAISON UNITS:

- The TLUs have become well regarded by their clientele and have been integrated into the research system.

- The TLUs have conducted diagnostic surveys to characterize and describe the complex production systems in their zones, identifying constraints and opportunities. This has contributed to improved on-station experimentation and has increased the sensitivity of on-station researchers to farmer problems.

- The TLU "mini-kit" technique has proved to be an effective tool in the transfer of IRA technologies to the farmer.

4. TRAINING:

- The advanced-degree training program of NCRE Phase II has completed the training of one M.Sc.-level agricultural economist and one M.Sc. sorghum breeder, and currently has six M.Sc. and three Ph.D. candidates in the United States. They are expected to complete their degrees by 1991. In addition, one other Ph.D. candidate and four M.Sc. candidates have been identified and are awaiting processing.

- The lowland maize-breeding program is led by a former NCRE Ph.D. training participant who demonstrates the project's potential to enhance IRA capacity to manage and conduct meaningful research.

- Eighteen participants received short-term training in Phase II at IITA, ICRISAT, IRRI, and CIMMYT. In addition, NCRE provided 12 in-service specialized courses in field research techniques, intensive maize production, surveys, and computers.

PRINCIPAL RECOMMENDATIONS WITH RESEARCH PROGRAM IMPACT

This section presents a summary of the recommendations that identify programs to be retained, modified, or phased out in view of the maturity of the research programs, the availability of IRA researchers, and the need to begin moving toward cereals and farming systems programs that are affordable for Cameroon. Greater detail is provided in the main body of this report.

Rice

1. The rice agronomist position in Dschang should be phased out at the end of the contract, handing the operation over to the Ph.D.-level Cameroonian recently posted to Garoua.

2. The rice breeder in Dschang should be moved to Maroua where he can have a greater impact on the major rice-growing zones of the country. Rice breeding should shift its focus away from higher yield toward quality and disease tolerance.

Maize

3. An IRA maize breeder should be posted in Garoua, the zone of rapid expansion of maize production, to assist the lowland maize breeder based in Nkolbisson. Although this move would increase Garoua operating costs, there would be significant savings in transportation and per diem on an overall program basis.

Sorghum/Millet

4. The sorghum/millet breeder position can be phased out in 1991 if the detailed phase-out plan in Annex I is followed to prepare for the development of a maintenance breeding program managed by a Cameroonian breeder.

5. The sorghum research activities in the Adamaoua and northern North provinces should be eliminated since these areas are rapidly becoming maize zones. Savings could be applied to defraying the SODECOTON charges for on-farm testing or shifting resources to millet research.

Testing and Liaison Units

6. TLUs should reduce the expatriate technical assistance to one per TLU; this will affect Maroua, Ekona, and Nkolbisson. The expatriate extension agronomists will be replaced by Cameroonian M.Sc.- and Ph.D.-degree

holders. The current expatriate commodity agronomy positions will be split equally between on-farm work with the TLUs and on-station support of the individual commodity programs.

7. The TLU Coordination Unit should seek to systematize the procedures used for each step in the technology generation and transfer process to achieve higher cost efficiency and develop standard methods that can be applied across the project area.

Cowpeas

8. The total experimental surface area should be reduced. Cowpea research has more than 20 hectares under experimentation. The savings in inputs, labor, per diem, and transport costs could be significant without affecting the overall program results.

Soils Sciences

9. Recruitment and installation of a soil scientist and a service laboratory at Nkolbisson with a Ph.D.-level counterpart shifted from another IRA program. Alternative institutional arrangements with TROPSOILS are also being explored by USAID and IRA. The estimated cost of the individual option would be an additional $125,000 in technical assistance salaries, plus about $35,000 in operating expenses.

Economic Analysis Capacity at Nkolbisson

10. A marketing economist has been proposed as an addition to the technical assistance team based in Nkolbisson to provide a policy perspective, perform marketing analyses in support of research, and advise IRA and NCRE on research priority setting. If recruited, the marketing economist would add $125,000 to the project in salary and benefits and require operating funds of $40,000.

Zero-Based Budgeting

11. A zero-based budgeting system coupled to a management information system should enforce discipline on researchers to economize and focus their research operations. Elements of this system are in place and should be instituted by project leadership.

Procurement and Construction

12. An administrative assistant should be recruited for Nkolbisson to concentrate on procurement. This will further reduce the procurement burden on USAID and will probably accelerate execution of this neglected area of project implementation. The additional

contract costs for a host country national would be less than $10,000 per year.

13. The budget for housing should be cancelled because of the favorable change in the availability of rental housing rear the stations. Housing at stations should have a lower priority than the construction of research facilities.

14. Construction is behind schedule. A compromise must be negotiated between USAID and GRC-regulating entities so that infrastructure development can proceed. In particular, seed drying and varietal storage facilities need to be constructed at the breeding stations to protect precious germ-plasm collections from heat and humidity.

THE COMPARATIVE ADVANTAGE OF CAMEROON AS A SITE FOR AID INVESTMENT IN AGRICULTURAL RESEARCH

Cameroon was placed by AID in the first tier of countries designated as technology-producing. These countries meet the criteria of surface area cultivated in foodcrops; a minimum of 100 scientists on the research staff; developed station facilities; a prioritized research agenda; network participation; a history of national support of the research budget; and a faculty of agriculture with the ability to teach, do research, and produce B.S. degree candidates qualified to do advanced degree training in the United States. These factors hold true today in Cameroon, with the major exceptions of a reduced level of national support for research and research priorities that are still unclear.

Should USAID continue to assume the recurrent costs originally attributed to the GRC under its assistance to NCRE? The evaluation team believes that the response should be a qualified yes, because of the relative advantages Cameroon possesses that give strong hope for project success. The qualification of USAID willingness to support recurrent operating costs comes from the need to determine what value Cameroon itself will place on research once it sorts out its adjustment program. Although the AID/Africa Bureau strategy makes clear that AID's commitment to research programs should be long term, 15-20 years or more, this position needs to be balanced with the country's commitment of budget support. The evaluation team believes that USAID should continue to support recurrent costs, guiding the program toward more efficient use of resources, and requiring that the GRC assume increasing amounts of the recurrent research budget over time. Certainly, by the end of Phase III, the GRC should be providing at least half of the NCRE operating costs, or research programs should be cut.

LIST OF ACRONYMS

CAPP	Cameroon Agriculture Planning and Policy Project
CIAT	Centre Internationale d'Agriculture Tropicale
CIMMYT	Centro International de Melherimento de Maize y Trigo
CIP	Centre Internationale de la Pomme de Terre
CIRAD	Centre de Cooperation Internationale en Recherche Agronomique pour le Developpement
CNS	Centre National des Sols
COP	Chief of Party
CRSP	Collaborative Research Support Program
CUDS	Centre Universitaire de Dschang University Center at Dschang (UCD)
DG	Director General
EEC	European Economic Community
FAO	Food and Agriculture Organization of the United Nations
GATSBY	GATSBY Foundation of the United Kingdom
GRC	Government of the Republic of Cameroon
GTZ	Gesellshaft fuer Technische Zusammenarbeit (German Aid Agency)
IBRD	International Bank for Reconstruction and Development (World Bank)
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IFDC	International Fertilizer Development Center
IITA	International Institute of Tropical Agriculture
INTSORMIL	International Sorghum and Millet Institute
IRA	Institut de Recherche Agronomique
IRAT	Institut de Recherches Agronomique Tropicales
IRRI	International Rice Research Institute
ISNAR	International Service for National Agricultural Research

MESIRES	Ministère de l'Enseignement Superieur, de l'Informatique et de la Recherche Scientifique
MIDENO	Mission de Développement du Nord-Ouest
MIDEVIV	Mission de Développement des Cultures Vivrieres
NCRE	National Cereals Research and Extension Project
MINAGRI	Ministry of Agriculture
MIS	Management Information System
OICD	Office of International Cooperation and Development (U.S. Department of Agriculture)
ONCPB	Office de Développement Rural de la Province de l'Ouest
PACD	Project Actual Completion Date
PP	Project Paper
ROTREP	Roots and Tubers Research and Extension Project
SAFGRAD	Semi-Arid Food Grain Research and Development
SEMRY	Société d'Expansion et de Modernisation de la Riziculture de Yagoua
SODECOA	Société de Développement du Cacao
SODECOTON	Société de Développement du Coton
SODERIM	Societe de Développement de la Riziculture dans la Plaine des Mbos
TA	Technical Assistance
TDC	Trial and Demonstration Center
TLU	Testing and Liaison Unit
TROPSOILS	Soil Management CRSP
UCCACO	Union Centrale des Cooperatives Agricoles de l'Ouest
UCD	University Center at Dschang
UNVDA	Upper Nun Valley Development Authority
USAID	United States Agency for International Development
USDA	United States Department of Agriculture
WARDA	West Africa Rice Development Agency

INTRODUCTION

The main body of the Midterm Evaluation of the National Cereals Research and Extension (NCRE) Project is presented here as a concise summary of the team findings and recommendations in the format required by the United States Agency for International Development Evaluation Handbook. This draft follows a series of meetings held at USAID/Yaounde and NCRE at Nkolbisson headquarters. Plenary sessions reviewing the findings of the evaluation were held at both locations. Errors of omission and commission pointed out have been corrected to the best of our knowledge; however, any errors and omissions are the fault of the individual authors. Similarly, judgments and opinions expressed are those of the authors and are not necessarily shared by USAID.

The executive summary of this report has been translated into French.

The evaluation team would like to express its appreciation to USAID/Yaounde, the Institute of Agronomic Research (IRA), the Ministère de l'Enseignement Supérieur, de l'Informatique et de la Recherche Scientifique (MESIRES), and the team from NCRE and the International Institute of Tropical Agriculture (IITA) for their assistance and hospitality during our stay in-country.

SECTION ONE

OBJECTIVES OF THE NATIONAL CEREALS RESEARCH AND EXTENSION PROJECT

Phase II of the National Cereals Research and Extension (NCRE) Project continues and expands the USAID/Cameroon investment in applied cereals and cropping systems research, technology transfer, and institution building begun in Phase I during 1979-1985 (Project 631-0013). Phase II began with project authorization on October 10, 1984, of a grant of $35.4 million and a loan of $3.6 million. Phase II has a project actual completion date (PACD) of December 12, 1994. The basic problem identified by the project was the lack of agricultural-production technology adapted to Cameroon's diverse agroclimatic zones and the needs of rural smallholders.

The long-term goal of the project is to increase agricultural production and rural development by building Cameroonian institutional capacity for applied agricultural research. The purpose of Phase II is to provide additional assistance to develop the capacity of the Institute of Agronomic Research (IRA) to provide high-quality research on maize, rice, sorghum, and millet and to facilitate utilization of research results by farmers. Four research-extension liaison structures called testing and liaison units (TLUs) are supported in Phase II to integrate cereals research into the cropping systems of the country's major agroecological zones in a way that focuses on the problems farmers face in food production.

The authorization of the 10-year Phase II effort was intended to expand the program in line with increased commitment of Cameroonian resources to research; provide sufficient time to train national researchers to the Ph.D. level so that they could take over national cereals subprogram leadership; and provide the basic facilities, resources, and time for AID and other donor projects to institutionalize Cameroonian research capacity. Cameroon was given an early designation as a regional technology-generating country within what was to become AID's Africa Bureau *Plan for Supporting Agricultural Research and Faculties of Agriculture in Africa.* The project design strongly supported USAID/Yaounde's broad program of investment in agricultural research (Roots and Tubers Research and Extension Project [ROTREP]) education (University Center at Dschang [UCD]), and statistics and planning (Agricultural Management and Planning Project).

SECTION TWO

PURPOSE OF THE MIDTERM EVALUATION

This evaluation fulfills the requirement of the Project Authorization that an independent and comprehensive evaluation of the project be conducted in fiscal year 1989. The purposes of the evaluation are to determine the extent to which major project and policy objectives have been advanced, and to recommend the extent to which the project should be continued and/or modified for fiscal years 1990 through 1994. More specifically, the evaluation team was directed by the USAID mission to examine the progress that the project has made toward achieving design objectives; to assess the effect that Cameroon's rapidly changing economic circumstances have had on the project and the national Institute of Agronomic Research (IRA); and to assess the need of ongoing research investment by USAID. The scope of work, with amendments, for the evaluation is given in Annex A.

SECTION THREE

TEAM COMPOSITION AND STUDY METHODS

A seven-person external evaluation team was assembled by USAID to evaluate the NCRE project. Team composition was:

Donald Humpal, Development Alternatives, Inc. (DAI), Team Leader and Agronomist
Steven Block, Abt Associates, Economist
James Bucknall, Abt Associates, Institutional Specialist
Roger Hanson, TROPSOILS CRSP, Soils Scientist
S.K. Reddy, REDSO/WCA, Research/Extension Liaison Specialist
Cary Raditz, DAI, Financial Analyst
Timothy Schilling, DAI, Plant Breeder

IRA provided Dr. J. Bakala, Deputy Chief of Nkolbisson Center, as a full-time evaluation team member. The Ministère de l'Enseignement Supérieur, de l'Informatique et de la Recherche Scientifique (MESIRES), the parent ministry, assigned its Inspector General, Dr. Nya Ngatchou, as a part-time team member. The USAID Project Officer, Mr. Gary Cohen, and his assistant, Mr. Peter Mbianyor, accompanied the team throughout the field work. Mr. Robert Shoemaker, Mission Evaluation Officer, also participated in field work.

The evaluation team spent five days in Yaounde in preliminary meetings and document review. The team, accompanied by the IRA senior researcher and USAID representatives, spent more than three weeks in field visits to NCRE project sites. The team was given formal briefings on project accomplishments and plans, reviewed ongoing trials, and held interviews with the technical assistance (TA) team and their counterparts. Key staff in cooperating research and development institutions were visited. Two work-weeks were allocated for subsequent work with IRA, analysis of documents and collected information, report drafting, USAID mission and NCRE/IRA review, and final report preparation. A list of individuals contacted is given in Annex C.

SECTION FOUR

KEY FACTORS AFFECTING THE NCRE PHASE II PROJECT

CAMEROON'S ECONOMIC CRISIS

The project paper (PP) assumed that Cameroon's economic growth would continue unabated. Public sector capacity to provide expanded support of both major investment and recurrent expenditures was unquestioned. The current economic crisis has radically altered the project's implementation environment, reducing the capacity of the Government of the Republic of Cameroon (GRC) to provide recurrent cost financing for research and, more important, financing and subsidy of credit, input supply, and marketing and processing organizations, which the project design assumed would promote strong demand for improved production technologies. The fundamental weakness of parastatal agricultural production, processing, and marketing institutions was revealed when public subsidy was no longer available to cover management inefficiencies and to protect industries from external competition. The economic context that shapes the current and future role of applied agricultural research in the country is provided in Annex E.

MISTAKEN DESIGN ASSUMPTIONS

The PP assumed that the World Bank Agricultural Research Support Project would expeditiously increase the overall research management capacity of IRA. For example, the PP looked for improvement in such areas as the development of a detailed, long-term research strategy and plan; improved human resource and personnel management; cost/benefit-based analysis of resource priorities and resource allocation; strong budgeting and expenditure control; and physical facilities development, maintenance, and operation. Progress on these fronts has occurred, but more slowly than the PP anticipated. The rate of improvement in research management and administrative capacity has not kept pace with the needs of the NCRE project.

The design assumption that a high level of soil analysis support would be available from existing IRA sources and donor projects was a major design flaw. Lack of soil fertility, soil testing laboratory, soil management, and soil conservation capacity has greatly reduced the efficiency of many agronomic trials, some breeding programs, and on-farm fertilization trials. Although highlighted for action by the 1987 evaluation, IRA, IITA, and USAID have not yet developed a solution to this problem. Partly as a result of this evaluation, however, institutional approaches to incorporating greater soil sciences contributions into research programs are under consideration.

THE SPECIAL NATURE OF THE CONTRACTOR

The International Institute of Tropical Agriculture (IITA) is the contractor for the NCRE project. IITA is a major international center for agricultural research and development. During most of NCRE's Phase II, there has been a steady process of redefinition and consolidation of IITA's mandate as expressed in its strategic plan and its medium-term plan. The medium-term plan calls on IITA to reduce its institutional involvement in direct management of country outreach programs, to consolidate its commodity and agroecological mandate, and to establish regional stations in the primary agroecological zones of interest. The humid tropical forest station, concentrating on cassava and land-resource management research, is located in Cameroon and its construction will soon begin. IITA's deputy director for international cooperation and training is the former director of IRA. Clearly, there are special ties between IITA and Cameroon that go far beyond the NCRE project.

At the same time, USAID is concerned that the implementation of new directions for IITA will make such a large demand on IITA management that the NCRE project may not be accorded the priority needed to meet its needs. Although the current director general (DG) has indicated that the IITA Board of Directors has given its approval to treat Cameroon as a special exception to retrenchment from outreach activities, USAID needs to ascertain whether the level of IITA management attention and responsiveness to the Cameroon-specific project needs can be increased, as is needed for the remainder of Phase II and for Phase III of the project. Pending that determination, USAID asked the team to examine the advantages and disadvantages of extending IITA's contract compared with other contracting possibilities. This examination is presented in Section Seven.

SECTION FIVE

FINDINGS

NCRE ACCOMPLISHMENTS

The NCRE project Phase II accomplishments cover many areas of research, extension, and training. The following table encompasses the highlights of NCRE accomplishments by project component.

TABLE 1

NCRE ACCOMPLISHMENTS, 1985-1989

1. BREEDING: Varieties developed and released by NCRE.

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3. TESTING AND LIAISON UNITS:

- The TLUs have become well regarded by their clientele and have been accepted and integrated into the research system.

- The TLUs have conducted a number of diagnostic surveys to characterize and describe the complex production systems in their zones, identifying constraints and opportunities. This has contributed to improved on-station experimentation and has increased the sensitivity of on-station researchers to farmer problems.

- The TLU "mini-kit" technique has proved to be an effective tool in the transfer of IRA technologies to the farmer.

4. TRAINING:

- The NCRE Phase II advanced-degree training program has completed the training of one M.Sc.-level agricultural economist and currently has seven M.Sc. and three Ph.D. candidates in the United States. They are expected to complete their degrees by 1991. In addition, one other Ph.D. candidate and four M.Sc. candidates have been identified and are awaiting processing.

- The lowland maize breeding program is led by a former NCRE Ph.D. training participant who demonstrates the effectiveness of the project's potential to enhance IRA capacity to manage and conduct meaningful research.

- Eighteen participants received short-term training in Phase II at IITA, ICRISAT, IRRI, and CIMMYT. In addition, NCRE provided 12 in-service specialized courses in field research techniques, intensive maize production, surveys, and computers.

PROJECT STRENGTHS AND WEAKNESSES

The evaluation team's findings on the project's strengths and weaknesses follow. They are organized by major themes abstracted from the terms of reference for the evaluation.

The Role of Agricultural Research in Today's Cameroonian Context

1. The project is well placed to adjust its research program to meet the current need of Cameroon to obtain significantly higher contributions to the economy from the agricultural sector, and the food crops subsector in particular.

The accomplishments of the project, summarized in Table 1 above, are evidence that the project has made major progress toward putting in place a capacity to identify and develop food-production technologies adapted to farmer needs.

2. The assumption made in the PP of ever-expanding effective demand to absorb increases in production due solely to higher-yielding cereals technologies was far too optimistic.

The success of the selection and breeding programs has led to varieties of maize, rice, sorghum, and cassava that generally have a 30 to 40 percent yield advantage under researcher-implemented conditions. Adoption of these varieties has the potential to boost production peaks to levels where price erosion would be significant, reducing the incentive to produce surpluses for sale. Under these conditions, research management priorities need to shift to identifying early- and later-season varieties to smooth production peaks; to examine ways to reduce farmer production costs and maintain return to labor and inputs; and to examine storage and processing options. Also, higher-yielding varieties may lead to greater nutrient export from the land. NCRE researchers and the evaluation team agree that soil fertility management should become a primary focus for agronomic investigation and that economic investigation of other constraints to technology development and diffusion needs to be undertaken.

Applied Research Output

3. Breeding programs have released varieties of maize, rice, and sorghum that have higher yields than earlier varieties and have other important and desirable agronomic traits. Chief among these traits are improved disease resistance, palatability, and grain color.

Maize, sorghum, rice, and cassava varieties have been released that significantly outyield older varieties. Breeders of some of these crops have also paid attention to the organoleptic qualities of the varieties released. The TLUs and the agronomy programs regularly put together taste panels that sample products derived from new and old varieties. Problems in preparation or with texture and taste are noted. If these are found to be major constraints to acceptance, the varieties are not recommended for extension. In two lowland areas, higher-yielding varieties of white maize were initially extended, but in both cases farmers asked for and received yellow varieties that brought higher prices on the roasting-corn markets.

4. NCRE programs (such as programs for maize hybrids in the highlands) have begun to address future agro-industrial considerations, postharvest management, and so forth.

Cameroon consumes substantial quantities of maize, much of which is imported, in its brewery and animal-feed industries. NCRE researchers are working on both open-pollinated and hybrid varieties that have better resistance to stored-grain insect pests as well as good milling and utilization characteristics. The hybrid program is used in the short term to extract desirable traits for incorporation into open-pollinated synthetic varieties, whereas the medium-term objective is to develop hybrids with substantial yield advantages for current and future growers supplying maize to oil, feed, and flour mills and to breweries.

5. Dependence on laboratories set up to characterize soils and the lack of IRA scientists trained in soil fertility and soil management disciplines have impeded the design, execution, and interpretation of agronomy and TLU trials, and to a lesser extent breeding work.

The two IRA laboratories at Ekona and Nkolbisson are soil characterization and classification laboratories. The UCD laboratory is also a characterization laboratory. Equipment and procedures used increase the cost and decrease the volume of trials that can be handled. Soil sample analysis costs nearly 10 times what a service laboratory in the United States would charge, and delays -- often four months or more -- in getting analyses back discourage researchers from using these facilities. Current agronomy trials on fertilizer response, use of alternative liming sources, manuring trials, green manure trials, crop-rotation work, and alley cropping are difficult to design and interpret without soils and material testing data. The original PP assumed that the Food and Agriculture Organization (FAO) and other donors would provide responsive soil testing capabilities, but these programs did not continue. All station and TLU researchers have attempted to get soils analysis done and have been successful in getting some characterization data back. However, the soil-fertility management trials require regular sampling, which no researcher has been able to obtain from current soil services. The soil management issues, which have been identified as perhaps the most important medium-term theme for the research program, will continue to be handled inefficiently until faster, less costly and easier soil-testing services are available.

6. Successful use of leguminous materials for fertilization is not evident. Researchers have tended to generalize legume treatments when the specific fertility problem and bioorganic approach may be much more location specific.

Legume approaches have advantages and disadvantages that researchers do not appear to be fully considering. Grain legume crops in rotation can provide some residual nitrogen effect (assuming that not all plant material leaves the field), but they may also provide good conditions for some crop pests and diseases. For example, the rainfed rice-soybean intercropping trials at two locations showed that the soybean intercrop favored the development of the stalk-eyed borer, which causes dead heart in rice. The green manure trials, which are general in the agronomy program, do not take into consideration the economic costs of production and incorporation of green manure. Even large, mechanized farm operators may not find the green manure technologies very attractive, as experience in similar environments in Africa has shown. Alley-cropping trials are part of three commodity programs. This technology is still not ready for testing on-farm, even at IITA. The alley-cropping efforts are long-term experiments, and need to be incorporated in a soils-

and land- management program at well-identified sites. It is questionable whether NCRE could not use its resources better working on alternative agroforestry approaches through the TLU, rather than planting alley-cropping trials on stations. Annex K treats the agronomy issues in greater detail.

7. The agronomy programs have generally paid little attention to weed control from both technical and economic points of view.

Despite the information collected by TLUs in surveys, the agronomy programs (with a few notable exceptions) have not paid the necessary attention to weed management. Agronomy trials that manipulate soil fertility and land-preparation practices often have a significant impact on weed populations and species composition. Too frequently, weeding requirements have not been tracked. The *Striga* activities in the north are an exception, as well as some of the land preparation trials in the Highland Maize Program. All of the TLUs have spent much more time on the weeding issues and conducted at least one on-farm set of trials; the Nkolbisson TLU is comparing crop management, hand weeding, and herbicide interactions in systems similar to those of farmers. The TA team does not yet make full use of a weed scientist in their group, apparently because his time is fully occupied by duties as the extension agronomist to the Nkolbisson TLU.

8. The rice program has concentrated resources in the Mbo plain instead of more important rice-growing areas in the country. Rice breeding and agronomic research is probably of a lower priority than marketing and food trade policy in addressing the problems of rice in Cameroon.

More than 70 percent of the rice-breeding research funding to date has been expended in or on behalf of less than 2 percent of the total rice-producing area in the country. Although, from 1975 through 1987, the Centre de Coopération Internationale en Recherche Agronomique pour le Développement (CIRAD) and the Institut de Recherches Agronomique Tropicales (IRAT) financed a rice agronomist to provide technical assistance to the Société d'Expansion et de Modernisation de la Riziculture de Yagoua (SEMRY), the IRAT scientist was not a breeder and there was little interaction with NCRE rice research. If the rice research program is to have significant impact on rice production in Cameroon, it will occur in the north where 80 percent of the total Cameroonian crop is grown (see Annex I). The rough analysis of available information performed by the team suggests that if significant gains are to be made toward making domestic rice competitive with imported rice, most of those gains will come in the area of postharvest handling and marketing. This conclusion follows from a brief study of the main components of domestically produced rice delivered to Douala, which shows that, at current costs, average yields would have to increase by a factor of over four to reduce the cost of production to a level competitive with imported rice (see Annex E).

Facilitated Technology Transfer/Testing and Liaison Units

9. TLUs have been accepted by commodity programs, extension agencies, and other donors as a valuable and integral part of the research system.

TLUs have contributed to the technology development and transfer process and established viable links with extension and development agencies. During the remainder of Phase II and the follow-on Phase III, TLUs should rationalize the volume and spread of activities and improve their quality.

10. TLUs have conducted farm- and village- level surveys, which characterized production systems and identified constraints, problems, and opportunities. They made strong efforts at systematic data collection, analysis, and presentation.

TLUs have close links and working relationships with on-station researchers. However, it is not evident that agronomic research, both on-station and on-farm, always responded to the identified production constraints. This phenomenon appears to be a result of the nature of agronomic research in the NCRE project, which has focused more on supporting varietal improvement work than on soil- and crop-management issues. NCRE should devote more attention to tightening the link between on-station experimentation and observed constraints.

11. TLUs has successfully moved improved varieties of maize, rice, sorghum, cassava, and cowpea through on-farm testing to the extension stage. Until recently, less attention has been paid to the social and economic analysis of technologies and their effect on production, productivity, and income.

The TLUs have carried out large numbers of variety and variety-by-practice trials that have identified the performance stability of new varieties across environments. Several varieties have moved into extension with multiplication and distribution carried out by parastatals, development projects, private foundations, and farmers. TLU staff have become increasingly aware of the need to determine the rate of adoption and diffusion of the technologies being extended and to evaluate the economic impact they have on farmers, marketers, and consumers. With the recent arrival of the full complement of TLU agricultural economists, TLU staff should be ready to perform impact studies.

12. TLUs have trained significant numbers of extension workers in new technologies, rapid rural-appraisal survey, and on-farm testing methodology.

On-farm research has been carried out with the assistance of extension workers from the provincial delegations of agriculture; coffee and cocoa parastatals and cooperatives; rural development authorities, such as the Mission for the Development of North West Province (MIDENO); irrigation parastatals, such as Upper Nun Valley Development Authority (UNVDA); and commodity parastatals, such as the Société de Développement du Coton (SODECOTON). In some areas, in particular the northern zones supervised by SODECOTON, the level of involvement of extension and production specialists in identifying, executing, and interpreting on-farm tests is extremely high. In other areas, linkages are weaker because the extension service is weaker. In these locations, TLUs have provided training and helped defray the costs of participation of extension agents in TLU-managed field activities.

13. Recent financial setbacks in SODECOTON have prompted that agency to require reimbursement for the cost of the time their extension agents spend on on-farm tests; this threatens to overextend the TLU budget.

Some costs of cooperation are acceptable when forging links to extension agencies, as long as the extension agencies do not begin to shift their recurrent cost burden to TLUs. SODECOTON, for example, is charging back to the TLUs costs of 50,000 CFA per foodcrop trial to defray field staff and supervisory expenses. This billing is made because SODECOTON's field agents are charged primarily with the promotion of cotton, even though sorghum, cowpeas, peanuts, and maize are essential elements in the cotton and foodcrop rotation system. A clear definition is needed of what the appropriate types and level of costs attributable to the TLU and extension agencies will be in each area. TLU staff point out that some charges may be reasonable, as their costs of performing on-farm tests would increase dramatically if they had to take over the full burden of farmer supervision.

14. A potential danger exists of overlapping roles and duplication between the NCRE/TLU Bambui and MIDENO trial and demonstration centers (TDCs).

MIDENO has an adaptive research unit funded by a multi-donor group. MIDENO has been conducting a parallel program of on-farm testing and is expected to intensify on-farm testing and rural appraisal surveys in Phase II. This will lead to both MIDENO and NCRE conducting on-farm testing, when there is only a limited set of technologies screened at the station and ready for testing on farms. Therefore, a potential exists for duplication of TLU adaptive-research activities by MIDENO, which would lead to a waste of both Cameroonian and donor-provided resources.

15. TLU procedures and methodologies need tightening to permit greater coordination, cost-effectiveness, and focus.

The TLU coordination cell was established in 1988 at Nkolbisson. TLU programs are highly individualized and provide several models for comparison in determining an overall approach for all TLUs. In examining TLU functions, the evaluation team found that the TLU coordination cell should now review the process from on-station screening, multilocational testing, researcher-managed and farmer-managed on-farm trials, regional testing through mini-kits, and demonstrations to set methods and degrees of analytical rigor to apply to each step. This should permit greater cost-effectiveness in TLU operations, particularly where sampling and survey work is involved. Formal procedures for printing technological information for use by extension agencies are needed, as is the systematic collection and reporting of feedback from on-farm testing. Finally, NCRE technical assistants need to allocate more time to staff training and give their counterparts increased responsibility in planning TLU operations, performing analyses, and preparing reports.

Participant Training/IRA Research Capacity

16. Of the 15 long-term students for M.Sc. and Ph.D. degrees slated for Phase II, one has returned, nine are in training in the United States and the remaining five trainees have been selected.

Thus the trainees have been selected, with one-third waiting to depart for training (see Annex G). This finding is positive, but the overall evaluation of the training program is less positive. The current training plan assumes that a student will spend 2.5 years obtaining an M.Sc. degree, one year working for IRA in Cameroon, and another four years obtaining a Ph.D. degree in the United States -- a total of 7.5 years if all schedules work perfectly. However, students who have returned from M.Sc. training in the United States after Phase I have found themselves still waiting to return to the United States for Ph.D. programs. The time required to work on the project, complete a new application, obtain approval, and obtain a Ph.D. degree is far too long to permit them to return and overlap with the expatriate technical assistance. The cumbersome GRC, IITA, USAID, and U.S. Department of Agriculture (USDA) selection and placement procedures have resulted in considerable delays in getting participants trained and re-integrated into the project. The team's conclusion is that the process has to be streamlined if future national program leaders are to be developed.

17. The project lacks a training plan that integrates degree training with the creation of relevant work and dissertation research opportunities within the project.

Participant trainee monitoring is carried out by the Office of International Cooperation and Development of the USDA. This office has no contact with NCRE other than training administration. Even when all parties want to communicate about the progress and problems a student is having with a particular program, the communication routes are circuitous and time consuming. Also, there is no specific planning for the integration of a student's M.Sc. program with his or her work experience, or a further linking to an application schedule for a Ph.D. degree. The team believes that giving training responsibility to the prime contractor implementing the project would provide a greater incentive to plan and manage the exit and re-entry of trainees.

18. Returning trainees have two complaints. First, technicians returning from general agronomy and extension M.Sc.-level training feel that the added knowledge they acquired was not worth the 2.5 year investment of time beyond their Ingénieur Agronome degrees. Second, IRA does not recognize the M.Sc. degree as being higher than the Ingénieur Agronome degree.

The first problem cannot be generalized to all M.Sc. programs. The breeding programs, agricultural economics, plant pathology, and other specialized M.Sc. programs were not criticized. The second issue greatly affects a student's career, as he or she receives no added promotion for 2.5 years of effort. The issue is clearly an issue of national higher educational policy and not one that NCRE can affect. IRA researchers suggest that MESIRES consider putting the M.Sc. degree on the same level as a "doctorat du troisième cycle" in the French system.

19. The Cameroonian counterparts frequently seem to be in the shadow of the expatriates. Counterpart relations in some programs seem to be characterized

by a "faculty-to-student" mode of operation. Cameroonian IRA staff working in NCRE seem to accept the PP assertion that the Ph.D. degree is the fundamental requirement for peer status and for research program leadership.

This finding is sensitive with both expatriates and Cameroonians. A TA project with an explicit scientist-training objective asks technical assistants to play the role of trainer of program leaders and supporting scientists and technicians while maintaining a collegial atmosphere. The tension in the two roles is handled unevenly in the project. Several technical assistants have found ways to reconcile the differences and share significant responsibility with their counterparts. Others are explicit in adopting the "faculty-to-student" mode. Still others don't appear to be conscious of the issue. Cameroonian staff informed the team that there has been marked improvement in relationships between Phase I and Phase II, but there is still a significant distance to go before Cameroonian researchers are accorded equal voice. At the same time, IRA managers believe that until their staffs have equivalent degree qualifications, they are scientists-in-training under the direction of the technical assistants. The evaluation team believes that technical assistance team management, or IITA, could exert additional influence to ensure that Cameroonian researchers are heard more frequently.

20. The Lowlands Maize Breeding Program, led by Dr. Charles The, a Cameroonian national trained under NCRE Phase I, demonstrates progress toward increasing IRA's research management capacity.

Dr. The has demonstrated that the schema envisaged in the project design is potentially a realistic one. After receiving his Ph.D. degree in maize breeding, Dr. The worked with NCRE technical assistants, went to IITA as a research associate, and returned to Cameroon in 1987 to take over leadership of the Lowlands Maize Breeding Program. He has successfully led the program, released new varieties and maintained a balanced breeding program that is challenging to supervise, because it covers large areas in both the northern and southern Cameroon.

Research Networking

21. NCRE researchers have proactively sought and established institutional linkages in Cameroon and have built formal and informal feedback channels with client groups and supporting organizations. The project has given high visibility to the researchers' contribution to increased agricultural production in Cameroon.

Annex I provides a listing and characterization of the major network linkages of NCRE garnered from conversations and reports. The NCRE breeding and agronomic programs are strongly linked to the international programs of the International Crop Research Institute for the Semi-Arid Tropics (ICRISAT), IITA, and the Centre International de Melherimento de Maize y Trigo (CIMMYT). NCRE also has strong ties to regional networks for maize, sorghum, and *Striga* control, among others.

Facilities Construction and Supporting Equipment

22. The lack of accountability, communication, and counterproductive GRC procurement requirements have resulted in no construction being started thus far in Phase II of the project.

The indicative requirements laid out in the PP for houses, offices, warehouses and laboratories did not reflect actual needs. USAID initiated a needs analysis in June 1986. The detailed needs were used to establish designs, many of which changed as technical assistants modified their original concepts. Architectural and engineering services were solicited and bid documents prepared and issued for the houses. Incompatibility between GRC and USAID procurement regulations caused additional delays, along with those caused by absences of the director of IRA, the only designated signatory power for the NCRE project within IRA. The housing contract has been let, but the housing market has changed. Rental housing can now be obtained off-station.

The IRA director believes that housing on-station is necessary to keep researchers interested in working at stations rather than in the city. The evaluation team believes that house construction on-station risks increasing recurrent cost burdens that would adversely affect the operations and maintenance of the scientific infrastructure of the station. First priority should be given to seed storage, laboratory, and warehouse space. A summary of existing facilities and their problems is given in Annex K. The institutional issues are discussed in Annex G.

23. Mistaken design allocation of procurement as a USAID function and lack of a formal and detailed system for identifying equipment needs within NCRE, along with poor procurement management, has resulted in slow purchasing performance.

In the first two years of Phase II all purchasing was undertaken by USAID. Difficulties with scientific procurement led USAID to assign a large portion of the procurement task to IITA in March 1988. Although some improvement has occurred, there is still no system within the NCRE project that can provide updated status on all procurement progress. Procurement is still split into two separately managed pools (see Annex G). This diffusion of responsibility should not be permitted to continue into the third phase of the project.

Research Management

24. NCRE has responded to the financial constraints of IRA in a prudent and helpful manner. This has strengthened NCRE integration within IRA and could lead to an improvement in IRA research prioritization as more careful allocation of funds among and within cereals research programs is done by both technical assistants and IRA researchers.

Annex F describes the financial setting of the project from the available accounting information. The information is incomplete but shows that substantial research is being accomplished with less money than was available before the economic crisis. Budget constraints are beginning to change the way that

Cameroonian researchers view the management of funds. However, there is still a long way to go, as the NCRE project team does not yet have a financial Management Information System (MIS) that is used for zero-based budgeting and expenditure control.

25. The project is producing a revised annual work plan with the potential to be a valuable decision-making tool.

The spreadsheet format of the annual work plan was put in place at the instigation of a former USAID project officer. It has served a useful role in focusing researcher attention on the distribution of resources against research objectives. NCRE's process differs from that of IRA overall by the added step of regional conferences, during which research projects are reviewed and modified before individual work plans are consolidated into the NCRE overall work plan. In some cases, as in the IRA/SODECOTON meetings in the north, the review process is a dynamic one with the client group specifying a substantial portion of the on-farm trial program. Annex G describes the general process in more detail.

26. The project has not developed a systematic framework or method for prioritizing research activities according to economic criteria.

Technical criteria have driven the project since Phase I, partly because technical criteria have been available. The extreme lack of relevant data severely limits an economic analysis of the NCRE project. At this stage, no basis exists for quantifying the benefits resulting from USAID/IRA research investments. Indeed, as the financial analysis section (Annex F) notes, generating even the cost data is a formidable task not yet entirely possible. This type of cost-benefit calculation is the object of a two- to three-year effort currently underway by the International Service for National Agricultural Research (ISNAR). Annex E analyzes the ISNAR cost-benefit model and suggests that the costs of trying to implement the model may exceed its benefit as a planning tool.

The NCRE team is aware of the potential pitfalls of the ISNAR model, and, within the past few months, the project has begun to pull together the analytic approaches needed for better assessment of adoption, impact levels, and economic analysis. There seems to be a commitment to incorporate such analyses into the prioritization of future research activities. Within the broader context of the project, TLU coordination has put in place what promises to be a good management structure for arriving at the most useful approaches to partial budget analysis, full farm enterprise budgets, and aggregate impact measures.

27. The three main programs -- breeding, agronomy, and TLUs, for each commodity -- are not adequately linked to each other to define research problems and interpret results.

The three main programs have been discipline bound since the beginning of the project. TLUs have helped to point out production constraints, and SODECOTON has helped even more as a client who demands that breeding, agronomy, and on-farm work address priority constraints. But, there is still a substantial gap between the

nature of farmer constraints and the distribution of resources in the research work plans. Annex H describes some of these problems and suggests concrete steps that can be taken to bring agronomy and TLU programs closer together.

28. The project failed early on to use soil science to evaluate the resource base for the application of their breeding, agronomy, and TLU programs. Despite the recommendation made in the 1987 evaluation, progress toward including soil science has been slow, notwithstanding the fact that four of the expatriate technical assistants teams are trained in soil science.

Faced with the shortage of soil information, the NCRE team has used other critical factors, such as rainfall, altitude, and cropping patterns, to evaluate the resource base. The TA team considers the soil analysis constraint to be a variable it cannot influence. There is a problem in research management at the NCRE project management level, and this concerns IITA, IRA, and USAID, none of which gave the issue high enough priority to generate senior management interest until recently.

29. The project underutilizes TA team human resources by not allocating sufficient time for individuals trained in specialty areas (soils, weed science, agroforestry) to interact with colleagues in other programs.

The recently arrived lowlands agronomist is the only scientist who has time allocated in his work plan to work outside of his particular area of assignment. He is one of the four scientists with soils specializations. The TA team's weed specialist is fully committed to the Nkolbisson TLU program, making it difficult for him to respond to requests for help from other parts of the country.

30. There is little evidence of an institutional priority to publish scientific papers and technical bulletins.

This lack of focus impedes communication and contribution by peer researchers worldwide and reduces client feedback to researchers. The SODECOTON/TLU/Cereals Agronomy interaction is the major exception to this finding, but here the client SODECOTON is the driving force and innovator in the publication process.

IRA Performance

31. IRA should be congratulated for the generally high level of counterpart staff that it has assigned to the national cereals programs. The evaluation team has found a high level of capability at Ingénieur de Travaux and Ingénieur Agronome levels, as well as the M.Sc.- and Ph.D.-level staff.

32. IRA's action plan was developed without sufficient consultation with center and station chiefs outside of Nkolbisson, some of whom have not seen the plan. Without their input it will be difficult for middle management to embrace senior management changes.

IITA Performance

33. IITA should be congratulated for assembling an enthusiastic, qualified, hardworking, and highly motivated staff, that has successfully integrated NCRE into the overall structure of IRA. The staff have demonstrated a penchant for action and competence in responding to the challenges of research with limited services and facilities.

34. IITA has provided some short-term assistance to the project in specialized areas. However, the assistance has been insufficient in amount and timeliness. This shortfall has been detrimental to progress in research design and execution.

35. The project suffers from a weakness in the use of fundamental financial management tools to systematically collect data, track project operations and costs at station and activity levels, and to conduct financial and operations analysis.

As Annex F describes, the current financial-tracking system permits tracking only to the level of researcher and by contract budget or voucher line item. Given the high level of cost overruns of research programs in some breeding operations and most agronomy operations, it is clear that cost tracking at the research activity level is needed.

36. At the station level, accurate inventory tracking has not been adopted as recommended by the AID Regional Inspector General and IITA/Price Waterhouse audits.

The new deputy chief-of-party is currently trying to reconstruct procurement records as the basis for an inventory system.

USAID Performance

37. USAID responded positively to the economic crisis by altering the major project design assumption of IRA's financial capacity, and establishing a stopgap special fund from the contingency budget to cover operating costs and prevent serious breakdowns in research activities.

As Annex G describes, without this action by USAID, there would be little NCRE project activity today. USAID provided special account facilities as a stopgap response to the lack of IRA operating funds. The drawdowns on these funds, however, have not been tied to IRA policy and operational changes that would gradually produce greater efficiency and cost savings.

38. IITA's role in setting the research agenda and evaluating research programs addressing Cameroon's needs was not clearly defined by USAID in the contract, in succeeding technical direction, or in the 1987 evaluation. This PP design flaw has not been corrected during project implementation.

39. The PP dealt only with pesticide and fertilizer risks in the generation and diffusion of cereals-production technology.

No consideration was given to the impact of new production technology on the types and intensity of land use in environments generallv considered to be at risk or having fragile soils -- for example, the humid forest lowlands, the western highlands, and the semi-arid and subhumid savanna zones (see Annex J).

40. The Cowpea Research Program in Maroua is in disarray with regard to operations and financial management, and lacks adequate supervision by funding and contracting sources.

Both Annex F and Annex I deal with the Cowpea Research Program. The program requires professional accounting assistance to resolve a confusing set of financial, administrative, and managerial issues.

SECTION SIX

RECOMMENDATIONS

The following recommendations are based on Phase II ending in December 1990, with Phase III beginning January 1981 and ending at the PACD.

The Role of Agricultural Research in Today's Cameroonian Context

1. Recognizing the importance of the agricultural sector in Cameroon's economic recovery, USAID should finance the recurrent costs of an adequate cereals research program. Recurrent cost financing should be phased out following a flexible schedule linked to Cameroon's economic recovery.

Focusing NCRE and IRA Efforts on Improved Research Management

2. The NCRE project should help establish IRA headquarters' capability to undertake agricultural policy and marketing analysis in support of research program development. The current Cameroon Agriculture Planning and Policy Project (CAPP) and UCD student and faculty assistance are not sufficient to identify and set research policy and handle the commodity system studies needed. The NCRE agricultural economics TA is more micro- and farming-systems focused. IRA, the NCRE team, and USAID should examine whether additional long-term assistance or a series of short-term consultancies is needed.

3. IRA should develop a five-year strategic research plan for 1990-1995 for NCRE commodity and farming systems research programs. The first five-year strategic research plan should be drawn up with NCRE assistance by January 1990, reviewed by an external scientific evaluation panel in February 1990, and implemented through the remainder of Phase II and into Phase III. This plan should use economic as well as technical criteria for determining plan priorities to the extent that this is practical.

4. USAID should set aside sufficient NCRE funds to support a periodic progress review of the five-year plan. A small multidisciplinary panel of scientists drawn from institutions external to those involved in project implementation should conduct the review. The purpose of the panel would be to stimulate scientific discussion surrounding the design and implementation of the plan, particularly in terms of prioritization of research needs, identification of strategic pathways to address the needs, and peer review of specific research activities or groups of activities.

5. NCRE should test and develop procedures for prioritizing research programs and examine a range of methods from qualitative and scalar to quantitative.

6. NCRE should begin applying cost accounting and operations data collection for program, researcher, and operations analysis, in addition to financial analysis to compare the budget against actual expenditures. Modifications to the existing codes and the D-base accounting system under design should enable operations-based cost tracking.

7. USAID should tie special account draw-downs to indicators of performance that track expenditures against budgets to control costs and improve the financial efficiency of the NCRE program. USAID must work in concert with other major donors such as the Caisse Centrale de Coopération Economiques (CCCE), the World Bank and the German aid agency (GTZ), to ensure that overall IRA recurrent cost obligations do not become excessive because of ongoing and planned projects.

Improving Participant Training/IRA Researcher Capacity

8. The NCRE project should prepare detailed long-term and short-term training plans for the period 1990 to 1995. The plans should be tied to a clearly established staffing pattern for each research program and include assignments for those researchers returning from training under Phase II. The objective is to have a fully trained Cameroonian staff capable of taking over the cereals and cropping systems program by the end of the project. If NCRE and IRA are unable to prepare this plan, they should prepare a scope of work to be executed by individuals from United States Title XII institutions or other qualified sources to identify requirements for human resource development by program and discipline. The plan will be explicit to 1995 and flexible to the year 2000. If the prime contractor determines it is necessary in Phase III to engage a subcontractor for participant training, USAID should consider approving a subcontract to a Title XII institution with proven capacity to place trainees, advise them while in training, and supervise dissertation research done outside of the United States.

9. The NCRE technical assistants should be required, as part of their terms of reference and time allocation in their work plans, to provide assistance to counterpart staff in the preparation of research project proposals, scientific articles, and technical bulletins.

Focusing Applied Research Effort

10. The NCRE team, with outside assistance, should identify postharvest handling, storage, marketing, and utilization constraints to adoption of higher yielding varieties and associated technologies, assess the returns to these lines of research, and include the promising ones as specific research activities in the five-year research plan to be developed by January 1990.

11. The NCRE project should undertake a study by the end of 1989 or early 1990 that would assess the impact of past and potential future trends in cereal and foodcrop-based farming systems on soil degradation, land productivity, land-use patterns, and nonrenewable natural resources. This study should concentrate on areas of current major damage and fragile lands, and formulate research needs to ensure farming practices which will provide adequate food, fiber, fuel, and shelter material production while maintaining or enhancing the natural resource base. Guidance to the best sources of expertise can be sought from AID/Science and Technology and AFR/ANR. A scope of work should be prepared by the NCRE team specifying the disciplinary composition and level of effort needed for such a study.

12. The NCRE project should consider requesting research services from collaborative research support programs (CRSPs) when they have strong comparative advantages. TROPSOILS should be considered for involvement in establishing a service-oriented soil testing facility, and developing the soil fertility management and soil conservation research programs of the project. A joint TROPSOILS and IRA assessment of soil research needs could provide the basis for this involvement. Existing TROPSOILS memoranda of understanding with both IITA and IRA should permit services of broad value to be delivered to the central soil support program of IRA. The International Sorghum and Millet Institute (INTSORMIL) could be involved in balancing the sorghum and millet research program with processing, utilization, and greater incorporation of local material in breeding programs. The prime contractor could use basic ordering agreements for these services to avoid the confusion of funding resources and reporting lines that has plagued the bean and cowpea CRSP.

13. USAID should scale back NCRE funding for rice research to a level just sufficient to avoid large future start-up costs in the event that rice becomes a more economically important crop. The remaining rice research activities should be reallocated to the northern rice production zones. The genetic improvement of grain quality has been underemphasized in setting breeding priorities. It is recommended that priorities be reviewed and that quality become the major focus of the program. The rice agronomist should be phased out and replaced by the recently returned Ph.D. rice agronomist now based in Garoua. IRA and the NCRE project should move the rice breeder to the Extreme North Province (Maroua) where rice breeding facilities already exist.

14. Breeder and foundation seed production and renewal has been neglected as a key link in the chain from research to grower, and this has affected rice production at the parastatals. It is recommended that the breeder obtain pure genetic stock of currently released material from the center of origin, and that it be properly maintained, multiplied, and distributed to parastatals with a formal system of renewal.

15. Phase III should provide for an IRA maize breeder in Garoua, because of the significant differences in agroecology of the subhumid savanna zone, the potentially strong linkage of maize production to agroindustry in the area, and the need to provide better oversight of the maize breeding program than can be done from Nkolbisson. The Garoua breeder would be supervised by the current lowlands maize breeder.

16. Emphasis on hybrid maize development in the lowlands seems premature given current and foreseeable seed production status in the zones of operation. It is recommended that operations on hybrid development be reduced.

17. One of the high-altitude testing stations is unrepresentative of the high-altitude maize environment and of questionable value to the breeding program. It is recommended that the Bambui upper farm location be dropped from future highland maize breeding operations.

18. The relatively high priority given to hybrid sorghum development appears to be unfounded given market demand and poor seed production prospects. It is recommended that operations of hybrid sorghum development be terminated.

19. Changing cropping preferences in the Adamoua and North provinces have not been addressed in terms of research priorities. It is recommended that all sorghum research operations be limited to the Extreme North and northern North provinces.

20. Local germ plasm has been largely ignored in the breeding program despite results indicating that some of these locals perform as well as or better than currently released material. It is recommended that local material be given more emphasis in the breeding program.

21. Production constraints for Muskwari (dry-season sorghum) appear to be largely agronomic. Breeding activities on this crop should be reduced to maintenance of germ plasm and interaction with the agronomist.

22. Research resource allocation to millet improvement is negligible and very little progress has been made in the development of millet varieties adapted to the millet-growing zones. It is recommended that the TLU economist initiate studies to assess the importance and constraints of this crop in North Cameroon and that the breeding program be restructured accordingly.

23. To improve focus on sustainable production systems, it is recommended that the lowlands agronomist position at Nkolbisson be designated as the NCRE production systems agronomist responsible for conceptualizing, designing, and implementing a comprehensive program of research for the development of soil- and crop-management technologies. Such a program should have both a medium- and long-term focus.

Facilitating Technology Transfer Testing and Liaison Units

24. In Phase III, TLU staff should include an agricultural economist or rural sociologist and an IRA agronomist trained at the M.Sc. level or higher. The on-station agronomists should devote 50 percent of their time to working with TLUs to conduct researcher-managed and farmer-managed on-farm tests, and to provide on-the-job training to less-experienced counterparts in the design, analysis, and evaluation of tests. The remaining 50 percent of the time, the on-station agronomists should developing commodity programs and conduct necessary on-station research on cropping systems research. At the beginning of Phase II there should be a sufficient number of agronomists in IRA trained at the M.Sc. level. However, there will not by any IRA economists qualified and experienced enough to guide the TLU program.

25. TLUs should devote greater attention to economic evaluation of technologies and to the design and execution of impact studies (see Annexes H and E).

26. NCRE project technical assistants should devote increased attention to staff training, giving the counterparts increased responsibility in planning TLU activities, analysis, and reporting.

27. TLUs should develop and publish informational material on IRA technologies for use by the extension agencies.

28. IRA management needs to take up with MIDENO the issue of facilities and work duplication if MIDENO intensifies its on-farm testing and identification activities in the Bambui plain area.

29. IRA management needs to discuss with SODECOTON the reduction of the 50,000 CFA cost of extension agents paid to monitor NCRE on-farm trial sites.

Facilities Construction and Supporting Equipment

30. USAID, in consultation with IRA and NCRE project staff, should cancel the housing construction contract that has been let. Funds saved could be put to other uses in the project. It should be noted that the director of IRA is opposed to this recommendation because he feels that housing is necessary on stations for the researchers returning from training. The evaluation team

believes that most stations are close enough to major towns, and that building houses for researchers will add to recurrent costs that IRA cannot afford.

31. A joint IITA/NCRE/IRA/USAID team should re-examine the construction plan and contract lot for offices, seed storage, and warehouse space. The feasibility of incorporating the construction activities under the IITA prime contract should be reviewed. In any event, an external engineering supervision contract should be let to avoid the low-quality of construction as performed under the IBRD loan in some stations.

32. NCRE should develop a detailed procurement plan for commodities needed until the end of Phase II. NCRE procurements should be reviewed by USAID in December 1989 to determine if procedures are working satisfactorily and to take corrective action if necessary. In Phase III the project should subcontract the purchase of all capital scientific equipment to an experienced Title XII institution or scientific supply broker with a strong record in supplying such equipment to overseas research projects.

33. Using data base software and a standard inventory card-filing system, NCRE should produce an inventory tracking system by early 1990 that is similar to the one used by the garage/workshop of the Cameroon Seed Multiplication Project.

Improving NCRE Project Management

34. USAID should amend the existing contract with IITA, if feasible, and with any future prime contractor to include all training, construction, and procurement responsibilities. The purpose of this change would be to redress the current lack of clear accountability for project management. The prime contractor would have responsibility for directing the work of any subcontractors to fit the needs of the overall project work plan.

35. The NCRE projects in-country team leader should be given responsibility and authority for identifying, scheduling, and writing terms of reference for short-term consultants; recommending candidates; and reviewing and approving candidates identified by the prime contractor to be submitted to USAID for approval.

36. USAID should provide, in the technical direction to the IITA/NCRE project team, for the presentation by a visiting scientist of a seminar covering his or her research work and/or the findings or results from his or her in-country assignment.

37. USAID should engage an accountant to investigate the financial condition of the Cowpea Research Program. This audit/review should reconstruct the sources

and uses of funds since the commencement of the project and seek documentation for expenses. The desired result is to clarify, and establish as needed, a systematic set of procedures that will allow this project to function on the same financial footing as other NCRE project programs.

IITA Involvement in NCRE Phase III

38. USAID should obtain from IITA a clear policy for the temporary transfer of NCRE project leadership from the current chief of party (COP) to the deputy COP when the COP is absent from the country or fully occupied on other IITA business during the rest of Phase II. Because the current COP has been named head of the regional IITA station in Cameroon, the transition to a new COP before the current expiration date of the IITA contract should be a requirement of any contract extension or Phase III involvement.

39. USAID should obtain from IITA a clear declaration of its interest in the NCRE project and how IITA would, as prime contractor, allocate sufficient management time to supervise its field team and subcontractors; improve overall technical backstopping; provide backstopping in rice, sorghum and millet; and address specific national needs relating to postharvest storage, marketing, and utilization of major crops and critical elements for sustaining production systems practiced by small farmers.

SECTION SEVEN

CONTRACTING OPTIONS AND TRADEOFFS FOR THE REMAINDER OF PHASE II AND PHASE III

Phase II

The recommendation that the NCRE project be implemented under a prime contractor, with subcontracting as necessary, presents USAID with a series of management options for the remainder of Phase II:

- USAID would shift all project implementation responsibility to IITA. Two primary questions are: does IITA have the management capacity to absorb major new responsibilities for managing construction and participant training, and is it feasible for USAID to negotiate the transfer of contractual management responsibility from itself to IITA in the next three months?

- USAID has already indicated that the construction component would be difficult to shift at this late date. At the same time, cancelling the housing-construction contract would permit IITA or USAID to hire a supervising engineering firm to control the quality of the station facilities constructed.

- USAID needs to consider the appropriate locus for management of the USDA/OICD subcontract for participant training. Currently, lines of communication are confused, but shifting the responsibility for training to IITA for the last one-and-a-half years of the current phase of the project may introduce greater confusion than that which currently exists.

- USAID needs to put short-term technical assistance to NCRE higher on the management agenda, requiring that the IITA in-country project leadership provide a quarterly plan for such support from IITA and other sources with clear terms of reference and qualifications required, and with monthly updating of the status of recruitment.

The team concludes that shifting all implementation activities to IITA is not practical, primarily because of the confusion it would cause, the high management costs involved if all contractual relationships needed to be changed again in January 1991, and the potential foreclosure of 1991 contracting options if an extension period to the current IITA contact was needed to permit transfer of contractual responsibility and performance of additional tasks.

Phase III (January 1991-December 1994)

Given the increase in institutional management and backstopping required if all implementation responsibility is to be vested with a single institutional contractor, it is extremely important that USAID consider contracting options and arrive at a decision on how to contract for Phase III by October or November 1989, so that announcement of procurement can be made in January 1990. This schedule should permit institutions to determine if they are capable of providing the full range of services required by the project. The team considered the following options and their tradeoffs:

- Extension of the existing IITA contract, with modification of responsibilities, reporting requirements, and clear definition of the responsibilities of headquarters and field team leadership responsibilities in terms of relationships with USAID and subcontractors.

- Incorporation of IITA as a subcontractor under a different institutional prime contractor for certain services. However, the evaluation team's discussions with IITA's DG indicated that IITA cannot serve as a subcontractor (a point to be clarified with the DG).

- The granting of a portion of the project to IITA -- for example, the maize program -- would put IITA in its preferred operating mode, but would make USAID management of the project more complex.

- Replacement of IITA by a Title XII institution as prime contractor would provide the opportunity for greater integration of participant training, potentially greater speed and accuracy in procurement of U.S. scientific equipment, perhaps greater responsiveness to USAID management concerns, and should improve the timely supply of short-term technical assistance. On the negative side, replacement of IITA by a Title XII institution as prime contractor would undoubtedly break project continuity; individuals with long-term ties to IITA could be lost to the project; a new contractor could take 18 months or longer to put people and management systems into place; research continuity could be broken in some programs; and research relationships between NCRE and IITA programs, including the new humid tropical forest station, would probably be strained.

- In an open competition, IITA should be capable of demonstrating its predominant capability as a tropical research organization, as a past NCRE prime contractor, and as an institution independently creating a long-term institutional link between itself and Cameroon. Competition would also provide USAID management with the opportunity to evaluate an IITA institutional response to the research management challenges, as well as the technology challenges, facing Cameroon, IRA, and the NCRE project. There is, of course, the chance that another institution would win the competition, or that IITA would choose not to compete, but if an offering institution can prove that it can provide better service to

the project and country, then the interruption of current activities described above may be a necessary price to pay for higher benefits from the project.

SECTION EIGHT

FINANCIAL IMPLICATIONS OF RECOMMENDATIONS

Taken as a group, the recommendations of the evaluation team would have the following financial impact on the project.

1. The evaluation team has determined that the rice breeder in Dschang should be moved to Maroua where he can have a greater impact. The net cost change is estimated at zero, but the benefit-cost ratio of his activities should increase.

2. TLUs are advised to reduce the expatriate technical assistants to one per TLU; the reduction will affect Maroua and Nkolbisson. Savings per year resulting from the reduction are estimated at $250,000, and the merger of operations could save approximately $50,000 in operating expenses.

3. The rice agronomist position in Dschang should be phased out at the end of the contract. The operation would be handed over to the Cameroonian Ph.D. recently posted to Garoua. This will yield savings in salary of approximately $125,000/year plus savings in annual operating funds from $30,000 to $40,000.

4. The sorghum/millet breeder position can be phased out in 1991 for a savings of $125,000 per year, if the detailed phase-out plan in Annex I is followed. Operations should also decrease by 25 percent (about $13,000) through the reduction of research activities as specified in Annex I.

5. The above savings could be reallocated to the recruitment and installation of a soil scientist and laboratory at Nkolbisson and to shifting a Ph.D. counterpart from another IRA program. The estimated cost would be an additional $125,000 in salaries for technical assistants, plus about $35,000 in operating expenses.

6. A marketing economist position has been proposed as an addition to the TA team based in Nkolbisson to provide a policy perspective and advise IRA and NCRE on the implications for research. If recruited, the marketing economist would add $125,000 to the project costs in salary and benefits and require operating funds of $40,000.

7. The team suggests that an administrative assistant be recruited for Nkolbisson to concentrate on procurement. The purpose of this change is to remove the procurement burden from USAID and accelerate this neglected area of project implementation. The additional contract costs for a host country national would be less than $10,000 per year.

8. As discussed above, a zero-based budgeting system coupled with MIS should result in researchers economizing and focusing their research operations. The evaluation team has also identified other activities that will reduce costs:

   a. Reduce the total experimental surface area. The Cowpea Research Program, for example, has more than 20 hectares under experimentation. The savings in inputs, labor, per diem and transport costs could be significant without affecting the overall program results.

   b. Eliminate sorghum research activities in the Adamaoua and northern North provinces because these areas are rapidly becoming maize zones. The savings potential is about $13,000, based on 1988 spending weighted by the 34 percent of time the breeder estimates for these activities. The savings could be applied to defraying the SODECOTON charges for on-farm testing or shifting resources to millet research.

9. The budget for housing should be cancelled because of the availability of rental housing rear the stations. Housing at stations should have a lower priority than the construction of research facilities.

10. Construction is behind schedule in the project. A compromise must be negotiated between AID and GRC regulating entities so that infrastructural development can proceed. In particular, seed drying and varietal storage facilities need to be constructed at the breeding stations to protect precious germ plasm collections from heat and humidity. The cost of each storage structure is estimated at $200,000.

11. Financial changes resulting from IITA subcontracting various research programs to other international research organizations are expected to have little net material effect on the NCRE project budget. The more important effects would be in efficiency in training and procurement, as mentioned above, which might accelerate the use of funds.

12. Other recommendations with respect to tying the special account facility to program and policy changes, revising the accounting system, building an inventory data base, instituting zero-based budgeting, and analyzing the Cowpea Research Program are treated above in the text.

13. In addition, an IRA maize breeder has been recommended to be placed in Garoua to assist the lowland maize breeder based in Nkolbisson. Although this could add up to $15,000 in Garoua operating costs, there would be significant savings in transportation and travel per diem.

SECTION NINE

THE COMPARATIVE ADVANTAGE OF CAMEROON AS A SITE FOR AID INVESTMENT IN AGRICULTURAL RESEARCH

Cameroon is currently placed by AID in the first tier of countries designated as technology-producing countries, because it meets the criteria of surface area cultivated in foodcrops, and has a minimum of 100 scientists on the research staff, developed station facilities, a prioritized research agenda, network participation, a history of national support of the research budget, and a faculty of agriculture with the ability to teach, do research, and produce B.Sc. candidates qualified to do advanced degree training in the United States. These factors, for the most part, hold true today. Cameroon's research agenda does need additional prioritization to respond to the requirements of decreasing recurrent budgets. Also, the reductions in operating budgets over the past three years has led some to question whether Cameroon considers agricultural research to be an important part of its economic adjustment strategy. USAID and other donors have, to a large extent, picked up the nonsalary operating expenses of the research system.

Should USAID continue to pick up these operating expenses under its assistance to the NCRE? The evaluation team believes that the response should be a qualified yes, because of the relative advantages Cameroon has, which give strong hope for success. Cameroon's future growth will most likely be led by agricultural production and agro-processing. Its agroecological diversity is one of the highest in Africa, permitting adjustments to cropping pattern that do not exist in many other African countries. Cameroon's road and rail network is one of the best in Sub-Saharan Africa. Cameroon has a national hydroelectric capacity that should enable it to provide lower-cost energy to industry. The level of education of Cameroon's people is relatively high, and USAID's assistance to the University Center at Dschang will establish B.Sc. and graduate programs similar to the U.S. Land Grant College. In short, many of the supporting factors needed to improve agriculture are present. The challenge is to make Cameroonian agriculture more efficient (lower production, marketing, and processing costs) so that Cameroon can feed its people reliably and increase its export sales. Already, the neighboring countries of Equatorial Guinea, Gabon, Congo, Central African Republic, Nigeria,and Chad are buying foodstuffs from Cameroon.

The qualification of USAID willingness to support recurrent operating costs comes from the need to determine what value Cameroon itself will place on research once it sorts out its adjustment program. Although the AID/Africa Bureau strategy makes clear that AID's commitment to these programs should be long term (15-20 years or more), this commitment needs to be balanced with a commitment at a similar level. The evaluation team believes that USAID should continue supporting recurrent costs, guiding the program toward more efficient use of resources, but requiring that the GRC gradually increase its support of the research budget. Certainly, by the end of Phase III, the GRC should be providing at least half of the NCRE project operating costs.

ANNEX A

NCRE PROJECT PHASE II SCOPE OF WORK AND SCOPE MODIFICATIONS

A.1. Original Scope of Work

BACKGROUND

A. General

The NCRE II project (631-0052) is the second phase of an anticipated long-term agricultural research development activitiy aimed at continuing the development of Cameroon's institutional capacity to provide high quality research on cereal crops and to facilitate transmission of research results to the farmer, toward the goal of increasing food production.

NCRE Phase I's primary objectives were to (1) develop Cameroonian-staffed institutional capacity for research on maize, rice, sorghum and millet; (2) develop and implement research programs in the above food crops including trial demonstrations on farmers' fields and produce research results relevant to problems faced by small crop producers; (3) develop and operate a Testing and Liaison Unit (TLU) to transmit agronomic research results to extension agencies and farmers' problems to the researchers; (4) establish and maintain links with international, African and Cameroonian institutions conducting agronomic and socio-economic research; and (5) provide adequate physical facilities and equipment for carrying out the cereals research program.

Based upon the final NCRE I evaluation, the project was thought to have achieved the following:

1) Maize breeders conducted research with the goal of producing disease and drought resistant varieties and maize agronomists studied fertilizer application and residue management. The TLU used results as a basis for on-farm tests.

2) Rice breeders developed varieties for various ecological zones and rice agronomists conducted research on improved fertilizer practices and soil preparation.

3) The sorghum and millet program emphasized varietal selection and improvement. The breeders made new higher yielding sorghum varieties available to farmers.

4) The TLU became operational, trained extension workers, tested new technology, developed farming systems methodology and collaborated on-farm tests.

The above evaluation helped guide the development of the Phase II effort aimed at (1) continuing institutional development of the Institute [illegible] Agronomic Research (IRA) and refining and increasing effort in the long and short-term training program; (2) insuring that research programs are developed for all agroclimatic zones; (3) establishing TLU's in all agroclimatic zones; (4) completing the physical infrastructure necessary to complete research objectives and; (5) refining research links with international research institutions.

This proposed evaluation will be the first evaluation of NCRE II and, as such, will assess project performance from 1985 and recommend technical and contractual direction to 1995, or present PACD.

As stated in the Project Paper, "Phase II of the NCRE project will continue the development of the institutional capacity in Cameroon to provide high quality, applicable research on cereal crops in different ecological zones of Cameroon, and will facilitate transmission of research results to the farmer. Phase II of the project will also continue to facilitate the development of appropriate linkages and feedback mechanisms so that agronomic breakthroughs, improved input use and improved farming practices support small farmer needs and requirements. The Testing and Liaison Unit (TLU) program will be expanded from one to four different ecological regions of Cameroon, and will continue to design the methodology of the field tests, coordinate the testing program, study and analyze the results, coordinate the research outreach activities with other organizations and, most importantly, service farmers' needs".

The NCRE Phase II project provides for 140.15 person-years of long-term technical assistance, 20 person-months of short-term consultancies, 15 participants trained at the level of the M.S. and Ph.D. degrees plus short-term training, more the $2,000,000 in supporting commodities, and about $3,750,000 in local cost support to research operations. The GRC's contribution was estimated to be 46.3% of the costs of the NCRE program.

The PP included a crop by crop and region by region analysis of the potential crop improvements for the target cereals. This analysis illustrates the extent of the international network which the project proposed to draw upon and the impressive gains that might result from successful adaption of available technology. The analysis acknowledges the classical problems of evaluating the stream of benefits from research and concludes;

- the major gains in production will occur about ten years after the PACD.

- in the period 1990-1995, 10% of the maize cultivated area will realize yield increase of 17% with the good farmers realizing increases of yield from 1 - 2.3 tons per hectare.

- 5% of the sorghum area will be cultivated with new varieties and technology by 1995 and yield will increase from 800 kg per hectare to 1.2 tons per hectare.

- the project will generate an annual increase in rice yield of 9,600 tons in 1995.

B. The Changing Project Circumstances

1) IRA

The GRC has adjusted to the sharp fall in export earnings and government income since 1985 by a sharp cut in the national investment budget, the account from which the budget of IRA as a parastatal agency is financed. As a result, between 1986 and 1988, IRA's recurrent cost budget fell by 24%. In response to projected continuing budget shortfalls, the GRC, in the context of the Structural Adjustment Program (SAP) it is developing in conjunction with the IBRD, has prepared a draft Action Plan for restructuring the IRA to bring that institute's objectives, priorities and operations in line with the GRC's projected budgetary capacity. The evaluation team should assess the appropriateness and adequacy of the changes proposed under the Action Plan in terms of Cameroon's emerging, priority research needs and the GRC's future ability to finance research, given the changing economic situation.

2) IITA as contractor

IITA was contracted to implement the USAID NCRE Phase I project in January, 1981. IITA had been the only institution responding to the bidding after Title XII Universities, other International Agricultural Research Centers (IARCs) and the members of the Consultatue Group on International Agricultural Research (CGIAR) were solicited. In March, 1985, IITA was approved as contractor for the NCRE Phase II effort based on successful justification for non-competitive procurement. It was determined that project continuity in areas such as institution building, technology transfer, policy dialogue and farming systems would be lost if IITA did not continue as contractor, and that IITA was more capable on a technical and organizational level to continue with the Phase II effort.

Currently with the events described above regarding GRC and IRA budgets, there has been a similar program evaluation and change of focus at IITA. The IITA Medium-Term Plan, approved and circulated in 1988, is the result of nearly two years of study and development by a special team operating under guidelines of the Consultative Group for International Agriculture Research and its Technical Advisory Committee. The plan outlines a program that will reduce the range of crops under study by IITA, sharpen focus on the problems of the West African countries, improve balance in support of national research programs and rely more heavily on networks of international research up-stream as well as national research and extension programs down-stream. The Medium-Term Plan is proposed to take effect for Cameroon at the termination of USAID's contract with IITA for the technical assistance requirements of the first half of NCRE. In conversations with IITA, CGIAR and others, it appears that IITA has some flexibility in following this plan and is seriously interested in continuing its technical assistance to complete the NCRE project. However, a full review of IRA's needs and the future resources of IITA is called for in establishing the validity of the current PP for continuation of NCRE and the contracting terms for the last half of the project.

3) Other areas of concern

A number of development activities in Cameroon also significantly affect the context within which NCRE undertakes research and extension work. These are briefly described here to illustrate the scope of the project evaluation that is needed, but the list is not intended to be a complete and definitive range of questions for evaluation. Also detailed below are certain concerns dealing with project and IRA management and organization. In some cases the evaluators may draw upon consultant reports (rice research) or other project documents (World Bank and FAO programs) to describe the new research environment for NCRE. The more important points of study are:

- The priority and approach for the rice research program given the apparent surplus production capacity in Cameroon.

- The adequacy of the IRA soils research program in supporting the NCRE agronomic and plant breeding program. Improvement in soils work has been sponsored by FAO and has not proven to be adequate for the needs of NCRE. How critical is this work to the future crop improvement program, and how can the most crucial needs be addressed within the resources of the project? Is there another route that might be followed to provide more adequately for the needed soils research?

- The Ministry of Agriculture is considering the reorganization of the extension services and has expressed an interest in redefining the linkages of the TLU with the field agents of the Ministry. The TLU program now collaborates in various ad hoc arrangements with these agents. Can, or should, certain ad hoc arrangements become a part of the new institutional collaboration and are there repercussions for such arrangements, i.e., new demands for seed of improved lines for expanded mini-kit programs, or demand for rapid increase in the number of lines in order to satisfy a wider range of agro-climatic zones.

- The University Center at Dschang plans to develop a research program in the Phase II part of the project to be initiated in 1991. Some collaboration between UCD and IRA exists at the IRA - Dschang Station and there are a number of possibilities proposed by both IRA and UCD staff for this and other stations. The evaluation should address the ways and means of developing strong professional linkages between the two projects that are consistent with the institutional guidelines of the Ministry of Higher Education, Computer Services and Scientific Research. Similarly, the evaluation should address the methodology for the NCRE project reinforcing IRA's linkages with and delivery of seed to distribution centers and extension services, such as SODOCOTON and MIDEVIV.

- IRA has made very effective use of several donors in developing its research program and facilities. The program has been planned and implemented with a considerable amount of autonomy for each project according to the resources available, however, experience is demonstrating numerous interdependent factors in the farming system. For example, farmers are shifting from the cash crops to the food crops which illustrates the need for better exchange of new technology

between the cash crop and food crop researchers in considering the impacts on the farming system. This introduces a need for more exchange between programs supported by USAID and those supported by the French. Also, the World Bank has given its attention to strengthening certain facilities and administrative services such as a headquarters computer center. The International Service for National Agricultural Research (ISNAR) was called in to consider these issues and address the changing management needs of IRA. The ISNAR study does not appear to be adequate and the evaluation should look more deeply into research management, concentrating more on IRA management issues that were not covered well in the ISNAR report. The evaluation should develop recommendations for NCRE that would ensure its most effective linkages to the other elements of IRA.

- The ISNAR report cited certain weakness within the management structure of IRA and indicated various other problems such as serious imbalances in the composition of research personnel (i.e. surpluses of mid-level administrators and shortages of technicans), the lack of standard operational guidance documents for all administrative and support tasks, and the need for preparation of a long-term national agricultural research plan. In view of the above, the evaluation should investigate the possibilities of an increasing management burden on IRA if IITA restricts and refocuses its mandate per the Medium-Term Plan, and leaves voids to be filled and dealt with by other agricultural research centers, such as WARDA, ICRISAT, etc. What will be the consequences for IRA for example, if and when IITA transfers rice research activity to WARDA, therefore introducing an additional center that must become integrated with IRA?

- Under the Africa Bureau Policy for Faculties of Agriculture and Agriculture Research,, the NCRE program has been one of the "flagship projects", a technology generating program. A recent summary of the utilization of IRA technology in neighboring countries has demonstrated a rather impressive list of benefits which has occurred without any significant promotion or support. IRA finds that it is good politics to make its know-how available to its friends, but it has also observed that this line of work does not pay. At present, the marginal costs and returns from technology generation are not a part of IRA management considerations, nor does the Bureau strategy provide guidelines for building these dimensions into a bilateral project. The issue to explore during the NCRE evaluation is the extent to which the experience to-date provides concepts and guidelines for necessary recurrent cost finding and for research and transfer to the regional clientele of the adapted technology generated by the project.

- The evaluation should, of course, consider the basic effectiveness of the NCRE project components: technical assistance, short term and participant training, commodities, facilities and support. In view of IITA serving as the contractor responsible for some of the above, the evaluation will ascertain where the contractor's strengths and weaknesses lie.

- During the last two years, the NCRE II project has funded some research and personal costs of an expatriate scientist under the USAID/Cameroon Bean/Cowpea Collaborative Research and Support Project (CRSP) (931-1320). The evaluation should address how critical the type of research being performed under this activity is, and how does the research fit into the overall NCRE agricultural research objectives.

- Given the current IITA contract termination date of December 31, 1990, the future status of IITA as project contractor in light of the IITA Medium-Term Plan should be considered, more specifically; impact or effect the plan will have on project success, both technical and administrative; effect the plan will have on IIIA's ability to recruit and retain staff;

- effect the plan would have on the organization and management of IRA and; recommendations to AID on future programmatic and contractual direction the USAID/IRA NCRE project should take. These recommendations should include a matrix listing pros and cons of different contractual options for this project.

- More specifically, and in light of the above, the evaluation should determine the implications of IITA sub-contracting for various project activities and the consequences for NCRE/IRA of a complete IITA pull-out at the end of 1990; (1) How will interim recruitment of researchers be undertaken if IITA pulls out and how will current researchers' length of service be phased out? (2) In the interium period, would it be wise to allow IITA to sub-contract for training, procurement and extension expertise? (3) The TLUs are major components of the NCRE project. IITA has indicated that more specialized institutions should handle the TLUs research extension component, even though the IITA Medium-Term Plan includes farming systems research activities. How would the TLUs be effectively transferred to another institution (i.e. contractor) without major delays in contracting and increasing the management burden of IRA? The evaluation should devote considerable effort to project management strategies and options which insure project continuity and steady progression. These strategies should be aimed at limiting the possibilities of increased management burden on IRA due to potential increases in numbers of cooperating institutions and/or donors.

ARTICLE I - TITLE

Project: National Cereals Research and Extension (NCRE) Phase II Project
Number: 631-0052

ARTICLE II - OBJECTIVE

To perform an evaluation of the National Cereals Research and Extension Phase II Project as fully described in the scope of work.

ARTICLE III - STATEMENT OF WORK

A three-person team is proposed for the evaluation. One of the team members should have experience at the senior levels of research administration preferably in the context of international development. Also, the extremely critical nature of the financial problems at present for IRA require strong experience and qualifications in financial analyst position in the evaluation team. The contractor is advised that at least one of the team members must be proficient in French at the S-3/R-3 level, and preferably all members would have that skill. The contractor is free to designate the team leader, the principal writer of the report, and the division of responsibilities in research, analysis and reporting of the various evaluation issues. The individual scopes of work are outlined below as indicative of the breadth of investigation that should be undertaken in this evaluation. The contractor may alter these responsibilities in light of the abilities and experience of the team assigned to the task.

A. Agronomist (Team Leader)

Review and assess the overall agronomic research program conducted under the NCRE project in terms of its relevance to the production constraints and problems (plant-related, soil and crop management practices, cropping patterns, socio-economic and institutional factors) and GRC projected budgeting capacity. Recommend changes as appropriate in the direction of agronomic research, its management and priorities.

The assessment should be based on the following specific issues:

1. The extent to which issues relating to the sustainability of production systems under low-input intensive cultivation have been addressed. Which techniques have been researched, tested, and the results achieved to date. Special attention should be paid to soil conservation measures, soil fertility maintenance practices, crop residue recycling, green manure, crop rotations, improved fallows and intercropping, livestock-crop integration, etc.

2. Choice of research objectives (problems), prioritization and allocation of resources between commodities and programs within commodities.

3. In the area of sustainability are the financial resources allocated commensurate with the emerging problems. If not, the agronomist should assess options for cutting back research programs to bring them in line with probable future IRA budgeting allocations.

4. The extent of coordination and collaboration between on-station research agronomist and TLUs (agronomists) in conducting agronomic experimentation with specific reference to the need for TLUs to conduct experimental work on-station and on farmers' fields (as against evaluation of technologies on farmers' fields).

5. Appropriateness of research designs, methodology, analysis and timeliness of reporting. Quality of research, supervision of trials, data collection and recording should also be assessed.

6. Assess the plant improvement program (rice, maize and sorghum) in terms of breeding objectives and strategies and relationship to priority problems in each of the three major crops funded under NCRE. Critically evaluate the approach or approaches followed by the three programs (introductions, varictal improvements and hybridization), in terms of its validity to the state of IRA resources and level of technology among farmers.

7. Assess the adequacy of research facilities and equipment (including data processing and documentation), availability of funds for research operations, and USAID support for procurement and construction.

8. Overall performance of the TA contractor (IITA) in terms of (a) adequacy of technical support and backstopping of the TA team; (b) short term technical assistance provided on specific problems.

9. The extent to which NCRE project utilized and participated in Regional Networks and Collaborative research support programs (CRSPs) to exploit the complementarities between national and regional research effort.

10. Examine the effectiveness of the linkage and coordination between cereals research, legume research (cowpea, peanuts) and tuber crops research (yams, cocoyams, cassava) in the context of of the wide spread mixed cropping/multiple cropping phenomena and identify problems of coordination, if any, due to diverse sponsorship or location in separate projects.

11. Assess the adequacy of IRA soils research capability and program, in supporting NCRE agronomic and plant improvement research, especially in the context of sustainability issues.

12. Recommend whether and what specific research problems or particular lines of enquiry (whose outputs might be less amenable to transfer) should be deleted, de-emphasized or reduced in scope to reduce total program cost to a level supportable given reasonable projections regarding IRA budgetary allocations. Provide approximate budget implication for each recommendation.

13. In coordination with other team members examine the options for adjusting to the changing role of IITA with respect to the provision of TA to the NCRE Project (read in conjunction with item 2 of the section "Changing Project Circumstances").

B. Financial Analyst

In the context of reasonable projections of GRC budgetary capacity and priorities, assess IRA capacity to finance recurrent costs associated with objectives and priorities outlined in the recently drafted Action Plan and identify options for meeting shortfalls including program cutbacks.

1. Estimate the current shortfall in GRC recurrent cost support and, based on IMF/IBRD estimates, project GRC recurrent cost support capabilities over the next 3-4 years.

2. Assess the budget, and particularly recurrent cost implementations of the recently adopted research priorities under the draft Action Plan.

3. To the extent that significant shortfalls are identified, in collaboration with other team members, develop a set of options the Mission might pursue in adjusting to those shortfalls. Consideration should be given to program cutbacks and reduction of inputs that will add to the recurrent cost problem (e.g., participant training, commodities, construction, etc.)

4. Assess the budget/accounting procedures and capacity of IRA personnel associated with the project and recommend ways for improving these systems/skills that might result in reduced recurrent costs.

5. Assess the adequacy of accounting/reporting procedures followed by the contractor and recommend any changes that should be implemented.

6. In coordination with other team members, examine the options for adjusting to the changing IITA role with respect to the provision of technical assistance to the NCRE project. Identify the financial advantages and disadvantages of each option.

C. NCRE Specialist

As team NCRE specialist, consultant will assist evaluation team in the collection of data necessary to complete the scope of work of the evaluation. He will assist in the data collection in all areas of evaluation scope of work (i.e. economic, agronomic, institutional and financial). The NCRE specialist will provide the following support to other team members:

1. Assist team agronomist in completing the analyses and assessments outlined in the scope of work, including, but not limited, to computer application in research design and analyses, general research methodology, objectives of plant breeding programs and overall performance of IITA as project contractor.

2. Assist team agriculture economist in assessing the economic/production impact of the NCRE project on the target population including, but not limited to, analyzing data availability and usage to monitor the project and assessment of NCRE research priorities and relevance of research agenda in the context of GRC resources and goals and the objectives of the parastatal reform program under the SAP.

3. Assist the Financial Analyst in (a) estimating NCRE recurrent cost support requirements associated with emerging research priorities, and (b) identifying options for meeting those shortfalls.

4. In coordination with other team members, analyze the current IITA contract and role in the project and develop options for NCRE adjustment to the changing IITA role in Cameroon and recommend future directions and institutional linkages for the NCRE project.

ARTICLE IV - REPORTS

The DAI team will work in conjunction with the other team members provided by Development Alternatives, Inc. in preparing their respective sections (see Scope of Work). This will include a first draft, and after Mission review and comment, a second draft in near-final form prior to departure from the Mission. Upon returning to the US, the agronomist will finalize the evaluation report including therein the sections prepared by the DAI team as well as the economic analysis and institutional analysis sections which will be provided by USAID.

ARTICLE V - TECHNICAL DIRECTIONS

The team will rely primarily on existing information sources (studies, progress reports) supplemented by intensive interviews with key informants in a rapid reconnaissance made and, as appropriate, visual observations.

Then the team will spend up to two weeks visiting IRA/NCRE field sites. This will allow approximately 6 days to complete a draft report for initial Mission review. Allowing 2 days for Mission review and comments, the team will submit it in nearly final form prior to their departure.

Development Alternatives, Inc.
624 Ninth Street, N.W.
Sixth Floor
Washington, D.C. 20001

May 24, 1989

MEMORANDUM

TO: Winifred Mulligan, Regional Contracts Specialist

FM: [redacted] McKenzie, Director of Administration

CC: Robert Shoemaker, USAID/Cameroon via FAX
Don Humpal, DAI/Sacramento

SUBJECT: Cameroon National Cereals Research and Extension (NCRE Phase II, Project No. 631-0052) Evaluation Work Order Reftel UNCLAS ABIDJAN 10596

The following are proposed modifications to the scope of work for the NCRE evaluation:

1. The Agronomist is designated as the team leader for this evaluation.

2. The scope of work for the Testing and Liaison Unit (TLU) will be the responsibility of the extension and outreach specialist to be provided by REDSO/WCA. This scope is found on pages 5 and 6 of the original scope. Other team members will interact with the REDSO/WCA specialist and assist in field visits and TLU analyses, but will not be responsible for the writing of the TLU section of the report.

3. The primary responsibility for execution of the Agronomist scope of work Item 11. will be that of the soil scientist to be provided by S&T Agriculture Benchmark Soils project.

4. The scope of work for the Scientific Advisor in Agricultural Sciences will be to:

AA. Assist the agronomist in analyzing the issues contained under Item 2 of the Agronomists scope of work (page 1), that is, "2. Choice of research objectives (problems) prioritization and allocation of resources between commodities and programs within commodities."

BB. Take full responsibility for Item 6 under the Agronomist scope of work (page 2.), that is, " 6. Assess the plant improvement program (rice, maize and sorghum) in terms

of breeding objectives and strategies and relationship to priority problems in each of the three major crops funded under NCRE. Critically evaluate the approach or approaches followed by the three programs (introductions, varietal improvement, and hybridization) in terms of its validity to the state of IRA resources and level of technology among farmers."

CC. Take primary responsibility for Item 9 under the Agronomist scope of work (page 2), that is, 9. Assess the extent to which NCRE project utilized and participated in regional networks and collaborative research support programs (CRSP's) to exploit the complementarities between national and regional research efforts."

DD. Assist the Institutional Analyst in executing Item 7 (page 11), that is "7. Assess the linkages between NCRE and other USAID projects including Tropical Roots and Tubers Research, Bean/Cowpea Collaborative Research and Support Project, Agricultural Management and Planning, Agricultural Education, North Cameroon Seed Multiplication, and the Fertilizer Subsector Reform Program in particular. Recommend approaches to improving those linkages.

EE. Undertake other team responsibilities as directed by the team leader.

5. Agricultural Economist SOW (pages 3-5). Add to general scope before the issues section the following statement: " Items 2, 3, and 4 will be done from a qualitative assessment of existing studies of the agricultural sector (IBRD/IDA), the national research system (ISNAR), the Draft Action Plan of IRA, and USAID analyses performed in support of the CDSS. Quantitative analyses of these policy and sectoral issues will not be the responsibility of the Agricultural Economist. Where existing studies are insufficient the Agricultural economist will so note in his/her report."

6. Financial Analyst. Discussions with the mission have revealed that two audits have been performed on the NCRE project recently, one by AID and the second by IITA. We were originally concerned that the items 4 and 5 (pages 9 and 10) required full-scale audits which could not be done by a single financial analyst in the time available. Items 4 and 5 should be combined into one point reading:
"Item 4. Assess the adequacy of recommendations of the AID and IITA audits and progress of the project in implementing the recommendations for improving budget/accounting procedures and capacity of IRA Finance Personnel and implications for future project implementation."

7. All evaluation team members should have the item: "Undertake other team responsibilities as directed by the team leader" as a part of their formal scope of work.

8. Please make the following changes in the Methods and Procedures section.

AA. Eliminate the sentence "Orientation is expected to include one day in Ibadan and up to two days in the mission." It has been agreed to reschedule the IITA visit later in the evaluation mission.

BB. Modify the final paragraph in the section to read, "The team will spend up to two weeks visiting IRA/NCRE field sites. The final work plan and travel schedule will be determined with USAID/Cameroon upon the evaluation team's arrival. A draft report will be prepared for initial Mission review eight days before team departure, allowing two days for review and comments. The final draft will be submitted prior to the team's departure. Ten copies of the English version of the report will be delivered according to work order instructions within one month of the team's departure.

CC. Translation of the document into French will take place in Washington, DC. The team leader will be allocated three additional working days in the USA to ensure the fidelity of the technical translation to the regional French technical vocabulary and the meaning of the English language text.

9. Section V. General Time Frame. Eliminate paragraphs's B and C. These items will be included in work plan finalization with USAID/Yaounde.

Annnex A.3. Final Scope Modifications

June 10, 1989

MEMORANDUM

TO: BOB SHOEMAKER, EVALUATION OFFICER/PDO; GARY COHEN, NCRE PROJECT OFFICER
FROM: DON HUMPAL, NCRE EVALUATION TEAM LEADER
CC: NCRE EVALUATION TEAM

SUBJECT: ALLOCATION OF NCRE EVALUATION TEAM EFFORT AND FINALIZATION OF THE EVALUATION SCOPE OF WORK

The purpose of this memo is to propose for mission approval final modifications of the scope of work and allocation of team effort for the evaluation. First, however, I would like to thank you for the intensive preparatory efforts made by the mission for our briefing and initial working sessions. The team appreciates all of the up-front work that was done to put documentation, meetings, and the mission CDSS presentation together for our arrival. We are off to a fast start. To ensure that we deliver a good product, I request your review and approval of the following points.

1. ALLOCATION OF 80 PERCENT OF THE TEAM EFFORT TO THE EVALUATION OF THE NCRE PROJECT. ALLOCATION OF 20 PERCENT OF THE TEAM EFFORT TO THE PHASE II.B. ALTERNATIVES AND BROADER QUESTIONS OF RESEARCH FIT IN THE BROADER ECONOMY. The rationale is simple: We will be in no position to contribute to a vision of the future if we do not nail down where NCRE is and how it got there. By concentrating our effort on how the project has worked, how it has responded to shifts in the IRA and broader institutional environment, we will be able to evaluate the near- and medium-term options for NCRE, and, perhaps, food crops research in general.

2. THE SOW FOR THE TLU IS THE RESPONSIBILITY OF THE REDSO/WCA REGIONAL AGRONOMIST. All team members will contribute to the evaluation of the TLU, but the writing responsibility for this component of the project rests with Dr. Reddy, as we discussed in our pre-trip telephone conversations.

3. TROPSOIL'S DR. HANSON WILL HAVE PRIMARY RESPONSIBILITY FOR EVALUATION OF THE SOILS SERVICES COMPONENT OF THE PROJECT (Item 11 of the original scope of the Agronomist). I will be pleased to contribute, but both the evaluation effort and TROPSOIL's interests will be best served by Dr. Hanson's strong comparative advantage in this area.

4. DR. SCHILLING WILL EXECUTE THE SCOPE PROPOSED IN DAI'S MAY 24 MEMORANDUM TO REDSO/WCA CONTRACTS: ASSESSMENT OF PLANT

5H'

IMPROVEMENT, THE REGIONAL NETWORKING AND CRSP's PARTICIPATION, AND ASSISTANCE TO THE INSTITUTIONAL ANALYST IN THE STUDY OF USAID PROJECT LINKAGES IN THE RESEARCH, AG EDUCATION, SEED, AND FERTILIZER PROJECTS.

5. THE AGRICULTURAL ECONOMISTS DETAILED SCOPE OF WORK WILL INCLUDE THE FOLLOWING PREFACE: " Items 2, 3, and 4 of the detailed scope will be done from a qualitative assessment of existing studies of the agricultural sector (IBRD), the national research system (ISNAR), the Draft Action Plan of IRA, and USAID's CDSS. Quantitative analyses of these policy and sectoral issues will not be the responsibility of the agricultural economist. Where existing studies are insufficient, the Agricultural Economist will so note in his report and suggest studies appropriate to their completion."

6. POINTS 4 AND 5 OF THE FINANCIAL ANALYSTS SCOPE WILL BE COMBINED INTO A SINGLE POINT FOUR READING: "ITEM 4. Assess the adequacy of recommendations in the AID and IITA audits, the progress of the project in implementing the recommendations for improving budget/accounting procedures and capacity of IRA Finance Personnel, and present the implications for future project financial management and administration." Two audits have recently been performed. The original scope implied that a financial analyst would, in essence, perform an audit.

7. DR. JAMES BUCKNELL IS DESIGNATED AS THE INSTITUTIONAL ANALYST AND MR. STEVEN BLOCK IS DESIGNATED AS THE AGRICULTURAL ECONOMIST FOR THE EVALUATION. Dr. Bucknell is a well-qualified economist, institutional analyst, and management specialist. His experience with public sector institutional management, institutional policy, and organizational behavior is evident and he is agreeable to this switch, providing that he can contribute to the economic analyses. Mr. Block has strong recent experience in agricultural policy issues and has the quantitative skills needed to perform the economic evaluation of research activities in the SOW. I am convinced that this switch will enhance the quality of the evaluation effort.

APPROVED: 6/12/89

ROBERT SHOEMAKER

ANNEX B

NCRE PROJECT PHASE II LOGICAL FRAMEWORK MATRIX

ANNEX B. NCRE PROJECT LOGICAL FRAMEWORK MATRIX

Project: National Cereals Research and Extension (Phase II)

Date: June 1984

Project Number: 631-0052

LOGICAL FRAMEWORK MATRIX - PHASE II

ANNEX A

NARRATIVE SUMMARY	OBJECTIVELY INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Goal: Increasing agricultural production and rural development.	Measures of Goal Achievement: 1. Increases in food crop production.	Goal: 1. GRC statistics, USAID-financed agricultural census and results of base-line study.	Goal Assumptions: 1. a) GRC developmental and budget priorities continue to stress agricultural production/rural development. b) Sufficient inputs and credit are available for food crops. c) Precipitation remains normal.
	2. Increased rural incomes.	2. Economic survey of TLUs.	2. Implementation agencies continue to coordinate efforts to maximize effectiveness.
Subgoal: Building an institutional capacity for applied agricultural research.	Measures of subgoal achievement: 1. Agricultural research institutions conduct research programs.	Subgoal: 1. Research Institution reports and periodic evaluations.	Subgoal Assumptions: 1. That adequate human and financial resources continue to be provided to agricultural research.
	2. Institutions staffed with trained Cameroonians.	2. GRC records and periodic evaluations.	2. That other donors provide sufficient assistance to other aspects of agricultural research.
Project Purpose: To provide additional assistance to the development of a Cameroonian capacity to provide quality research on maize, rice, millet and to continue to facilitate utilization of research results by farmers. Cereals research will continue to be integrated into a cropping systems approach to food production and be aimed at the problems of farmers.	Conditions that will indicate purpose has been achieved EOPS: 1. Cereals research program fully implemented without external assistance after December 1994.	1. Research institution records and periodic evaluations.	1. That sufficient number of Cameroonians are trained.
	2. Produces research results relevant to problems faced by food crop producers and parastatal enterprises.	2. GRC records and periodic evaluations.	2. That GRC continues to place very high priority on cereals research.

NARRATIVE SUMMARY	OBJECTIVELY INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
	3. Meshing cereals research with research on other food and parennial crops to develop cropping systems recommendations for each agro-climate region.		3. That socio-economic analyses closely tie in with agronomic research and continue to be taken into account in designing research programs.
	4. Establishment of linkages: a) With other national and international agricultural research centers. b) With implementing agencies/ institutions in Cameroon.		4. a) That results of field tests continue to be taken into account in designing future research. b) That various ministries and institutions will coordinate research and work together on design and testing of extension practices.
	5. Establishment of adequate physical facilities for cereals research.	5. GRC records and site surveys.	5. That land be made available for research; construction completed as planned, and that maintenance and spare parts continue to be available.
Outputs: 1. Development of Cameroonian staffed institutional capacity to conduct applied national cereals programs.	Magnitude of Outputs: 1. Cereals research staff including 18 researchers with Ph.D degrees by 1985.	1. GRC and USAID records.	Assumptions of Outputs: 1. Personnel can be released for training and once trained remain attached to IRA.
2. Development and implementation of research programs for maize, rice, sorghum and millet including field trials demonstrations on farmers' field.	2. Research Programs: a) Long-term maize, rice, sorghum, and millet research plan 1981. b) Begin implementation of research programs on stations starting in 1982.	2. GRC and research institutions records.	2. Coordination between IRA and agencies utilizing research results; sufficient staff available; and funds available for operations.

NARRATIVE SUMMARY	OBJECTIVELY INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
3. Development and operation of Testing and Liaison Units (TLUs): to transmit agronomic research results to extension agencies and farmers' problems to the researchers and to determine economic and social consequences of agronomic research.	3. Testing and Liaison Units: a. Establish first unit 1981 and 3 additional units by 1985. b. Begin designing field tests 1981. c. Analyze results 1982. d. Research results released when high yielding, stable and diseases resitant varieties are obtained. e. Farmer field trials executed and extension packages are distributed.	3. GRC research institution records, field survey.	3. The extension services of the Ministry of Agriculture and the parastatal organizations collaborate with TLUs.
4. Establish and maintain an exchange of information with international, African and Cameroonian institutions conducting agronomic and socio-economic research.	4. Continuous contact with institutions by FY 1981.	4. GRC, USAID records.	4. The Technical Assistance team and Cameroonian counterparts actively coordinate an exchange of information.
5. Adequate physical facilities and equipment for carrying out the cereals research program.	5. Adequate facilities for research in various distinctive ecological zones: a. land b. buildings c. farm equipment d. laboratory equipment	5. GRC records and evaluation.	5. GRC makes land, planting materials and buildings available.
Inputs: 1. AID a. Personnel: long-term contract advisor b. Participant training c. Commodities d. Construction e. Other Costs	Magnitude of Inputs: ($64.5 million): 1. AID (39.0 million) a. Personnel ($14.3 million) long-term and short-term advisors b. Participants ($2.3 million) c. Commodities ($2.0 million) d. Construction ($2.7 million) e. Other Costs & Inflation/ Contingencies ($17.7 million)	1. USAID records, evaluations.	Inputs Assumptions: 1. That adequate funds are made available.

NARRATIVE SUMMARY	OBJECTIVELY INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
2. Host Country a. Personnel b. Land c. Other Costs d. Equipment e. Buildings	2. Host Country: ($32.4 million) a. Personnel (salary) ($7.7 million) b. Land and Buildings ($4.8 million) c. Other Costs ($8.1 million) d. Contingencies/Inflation ($11.8 million)	2. GRC records and evaluations.	2. That GRC continues to make funds available on timely basis.

ANNEX C

INDIVIDUALS CONTACTED

ANNEX C

INDIVIDUALS CONTACTED

List of persons encountered during the evaluation.

USAID/CAMEROON

Mr. Jay P. Johnson, Mission Director, USAID
Mr. John Balis, Mission ADO
Mr. Gary Cohen, NCRE Project Officer
Mr. Bob Shoemaker, Evaluation Officer, Program Development Office
Dr. Tham Truong, Program Economist, PDO
Mr. Butch Asmundson, Assistant Mission Director
Mr. Peter Aku Mbanyior, NCRE FSN, ADO
Mr. Thomas Hagel, PDO intern
Mr. Norm Olsen, Chief PDO
Mr. Brian Ames, Economist
Mr. Tjip Walker, FSSRP Advisor

IITA

Dr. Larry Steifel, Director General
Dr. Ivan Buddenhagen, Maize Program Director
Dr. F.R. Moorman, Soil Scientist

NCRE TA Team

Dr. Emmanuel Atayi, COP, Nkolbisson
Dr. Thomas C. Stilwell, Deputy COP, Nkolbisson
Dr. John A. Poku, Extension Agronomist, Nkolbisson
Dr. Doyle C. Baker, Agricultural Economist, Nkolbisson
Mr. James Cross, Administrative Officer, Nkolbisson
Dr. V. Balasubramanian, Maize Agronomist, Nkolbisson
Dr. J. Kikafunda-Twine, Maize Agronomist, Bambui
Dr. Leslie Everett, Maize Breeder, Bambui
Mr. Dermot McHugh, Agricultural Economist, Bambui
Dr. Animesh Roy, Rice Agronomist, Dschang
Dr. Monthy Jones, Rice Breeder, Dschang
Dr. Om P. Dangi, Sorghum Breeder, Maroua
Dr. Lallan Singh, Cereals Agronomist, Maroua
Mr. John Russell, Extension Agronomist, Maroua
Dr. Mulumba Kamuanga, Agricultural Economist, Maroua
Dr. Henri Talleyrand, Cereals Agronomist, Garoua
Dr. Susan Almy, Socio-Economist, Ekona

MESIRES

Dr. Abdoulaye Babale, Minister

IRA

Dr. Jacob A. Ayuk Takem, Director IRA, Chief of Centre, Maize Breeder, National Coordinator NCRE Project, Nkolbisson
Mr. Bakala, Cocoa Phytopathologist, Nkolbisson
Mrs. Christine Poubom, Extension Agronomist, Ekona
Mr. Manfred Besong, Agricultural Economist, Ekona
Mr. Appolinaire Moukam, Chief of Station, Ekona
Mr. Frederic Tchuenteu, Head, Soil Laboratory, Ekona
Dr. Joseph Morin, Chief Research Advisor, Ekona
Mr. M. Foyet, Chief of Center, Njombe
Mr. Fabien Jeutong, Rice Breeder, Dschang
Dr. Samuel Nzietehung, Chief of Station, Dschang
Mr. Joseph Fokou, Rice Agronomist, Dschang
Mr. Julius Takow, Agronomist in-training, Dschang
Mr. Cletus Asanga, Entomologist, Dschang
Dr. Simon Lyonga, Chief Root Program, Dschang
Mr. Edward Nassah, Chief of Station, Bambui
Mr. Francois Meppe, Maize Agronomist, Bambui
Mr. Claude Nankam, Pathologist, Bambui
Mr. Isidore Tabi, Maize Breeder, Bambui
Mr. Ndioro Mbassa, Maize Breeder, Bambui
Mr. Christopher Ngong, Maize Agronomist, Bambui
Mr. Jean Enan, Agricultural Economist, Bambui
Mr. Zachee Boli, Chief of Center, Maroua
Dr. Moffi Ta'hama, Entomologist, Maroua
Mr. George Ntoukam, Enotmologist, Maroua
Mr. Richard Kenga, Sorghum Breeder, Maroua
Mr. Ranava Dikawa, Sorghum Agronomist, Maroua
Mr. Martin Fobasso, Extension Agronomist, Maroua
Mr. Charles Njomaha, Agricultural Economist, Maroua
Mr. Jaques Beyo, Sorghum Breeder, Maroua
Dr. Fobe, Rice Agronomist, Garoua
Mr. Titus Ebete, Cereals Agronomist, Garoua
Dr. Njita F. Clement, Soils Specialist, Garoua

ISNAR

Dr. Rudolf Contant, Management Specialist
Dr. Kham Pham, Economist

MIDENO

Mr. Mdonyi, Project Manager, Bamenda
Mr. Ayebi, Chief Research Officer, Bamenda

SODECOTON

Mr. Lucien Gaudard, Director of Rural Development, Garoua
Mr. J. D. Bekolo, Deputy Director of Rural Development, Maroua

MINAGRI

Mr. Edouard Mezazem, National Extension Coordinator, Yaounde
Mr. Nami, Provincial Delegate, Buea
Mr. Goulemond, Provincial Delegate, Garoua
Mr. Flavian Kamga, Provincial Delegate, Maroua

IRZ

Dr. Emmanuel D. Tebong, Director
Mr. Seller, Research Officer

IBRD

Mr. Joe Tangzi, Parastatal Reform Commission
Mr. David McMinnick, Agriculture and Rural Development Representative
Mr. R. Alan Yates, Africa, Technical Department, Agriculture Division, DC
Ms. Lynn Wardle, Financial Analyst

CIRAD

Mr. Jean-Louis Messager, Cameroon Delegate, Yaounde
Mr. Rene Kaiser, IRA Research Operations Chief, Nkolbisson

MIDEVIV

Mr. Abong, Director General, Yaounde
Mr. Awa, Deputy Director, Yaounde
Mr. J. Elang, Director, Projet Semencier, Garoua

UNIVERSITY CENTER AT DSCHANG

Dr. Rene Owona, General Director
Dr. Peter Hartman, CUDS Chief of Party
Dr. Eric Van Ranst, Soils Department Head
Dr. Francois Kamajou, Economist
Dr. J. Ndjoukam, Animal Science Department

CAPP

Dr. Frank Moore, Chief of Party
Dr. Peter Wyeth, Economist

ROTREP

Dr. Emmanuel Acquah, Chief of Party
Dr. O. Onokpise, Plant Breeder
Dr. Simon Zok, Tissue Culturist

OTHERS

Mr. Yacouba Aboubakar, Mission Chief, Agrilagdo
Mr. Jean Baptist Yonke, Director SODERIM
Dr. Samuel Wanki, Director UNDVA
Mr. J. Wanche, Production Chief, SEMRY

ANNEX D

DOCUMENTS CONSULTED

ANNEX D

DOCUMENTS CONSULTED

EVALUATIONS

Judy, W.H.
"The impact of agricultural research on end-users and pass-through users of NCRE/Rotrep and Bean/Cowpea projects." 9/88. 4p.

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Talleyrand, H. (IRA-Garoua)
"Impact of NCRE maize agronomy research on the agricultural production and income of small farmers in the subhumid zones of North Province of Cameroon" 8/88

ISNAR
"An analysis of structure and management of the IRA and the IRZ in Cameroon" 12/87, 80p.

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ANNEX E

ECONOMIC ANALYSIS

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ECONOMIC ANALYSIS

NCRE, Agriculture, and the Economic Crisis

Cameroon's economic crisis has had profound implications both for the NCRE project and for the agricultural sector. USAID designed the current phase of the NCRE project in 1983/84, at the height of Cameroon's oil boom. At that time, GDP was growing at the remarkable rate of six percent per year, the IRA budget had just doubled, and GRC revenue was growing at 27 percent per year.

In designing NCRE Phase II, USAID assumed that the economic boom would continue, and justified the project accordingly in the Project Paper (PP). Implicit in that design was the assumption that in the context of continued economic growth, there would be no limit on the effective demand for foodcrops. The economy was assumed to be capable of absorbing all production increases resulting from the research program, thus creating a strong incentive for farmers to adopt new technologies.

Subsequent changes in the Cameroonian economy are well known: oil and commodity prices plunged in 1985/86, initiating a general economic decline. GDP declined 8.6 percent in 1987/88, the current account deteriorated dramatically, and the GRC debt and fiscal deficit mounted.

One gains some insight into the implications of the crisis for agriculture's role in the economy by comparing the contributions of agriculture during and prior to the oil boom. At the height of the boom in 1984/85, the agricultural sector accounted for 20 percent of GDP and 28 percent of total exports. Yet, before the oil boom, agricultural had played a significantly more dominant role: during 1971/75, agriculture comprised 30 percent of GDP and 82 percent of total exports. Within agriculture, foodcrops contributed 54 percent of total value added, compared with 21 percent of value added from export crops. Throughout both periods, agriculture continued to employ three-fourths of the population.

Now that Cameroon has entered what appears to be its post-oil era, there is no alternative to agriculture resuming the lead role in driving economic growth and recovery. Income generation for three-fourths of the population will be critical in supporting sustained economic growth.

The crisis undermined several of the NCRE PP's key economic analyses and assumptions, in particular the GRC's ability to meet its $25.5 million counterpart funding commitments for agricultural research. Yet, for the same reasons that it reduced the GRC's ability to finance agricultural research, the crisis also increased the importance of agriculture in the Cameroonian economy.

The consequences of the crisis for effective demand for cereals is unclear. The 1978 National Nutrition Survey reflected that cereals play a large role in the Cameroonian diet -- three-fourths of family members nationwide consume cereals. The World Bank Agriculture Sector Memorandum presents empirical evidence from selected countries comparing the income elasticities of demand for various food groups. For most income groups, the income elasticities for coarse grains and rice are significantly lower than those for meat products. This suggests that to the extent that the crisis has reduced real incomes, reductions in meat consumption would be proportionately much greater than those for cereals. Moreover, Cameroon's rapid population growth rate (3.2 percent) and its high rate of urbanization (7.9 percent) would tend to reinforce the effective demand for cereals. Although a serious examination of trends in effective demand would require econometric analysis of time-series household survey data, there should be no presumption that the crisis has severely undercut the effective demand for cereals.

The economic analysis used in the PP to justify the project was based on specific assumptions regarding yield increases and adoption rates. For maize, the PP envisioned 10 percent adoption by 1990-1995, and 17 percent by 1995-2005, with yields approaching 2.3 tons/ha. At this stage of the project maize yield increases in trials are on target. Information regarding adoption rates, however, is scant. The team's impression was that adoption rates exceed 10 percent in the immediate vicinity of the TLUs, but one cannot judge beyond that.

For sorghum and millet, the PP relied on 5 percent adoption by 1990-1995, and 12 percent adoption by 1995-2005, with yields of 1.2 tons/ha. As in the case of maize, sorghum yields are on target. Adoption rates, though lacking in thorough documentation, also appear to be at or above 5 percent, largely due to the extension activities of SODECOTON in the primary sorghum production zones. One should note, however, that increasing numbers of producers in the north have been substituting maize for sorghum in their fields.

Regarding rice, the PP was based on an increase in total production of 9,600 tons by 2005. A 1989 IITA/NCRE rice study reported production of approximately 90,000 tons in 1984, and projected total domestic rice production of 180,900 tons by 1990, suggesting that rice production (along with maize and sorghum) is generally in line with the requirements of the PP's economic justification of the project.

Technology Development vs. Other Constraints to Agriculture

There exists a broad consensus within USAID/Cameroon that agricultural research is important and will remain one of their core activities. The questions for the future are thus how large should that effort be, and what specific form should it take. These questions lead directly to what proved to be the most problematic question in the economist's scope of work for the evaluation: where does lack of improved agricultural technology rank alongside of extension, input and output marketing, transportation, and pricing as a constraint to growth?

A rigorous quantitative ranking of how binding each of these constraints are relative to one another requires a separate study of substantial magnitude. Such a study might involve a complex linear programming model which would need to be region-specific, given the great diversity of physical and economic conditions in Cameroon.

There are no existing studies of the rural sector in Cameroon that attempt to quantify the returns to investments in any of these individual areas, and none that attempt to rank them relative to one another as constraints to growth. (At least, no such studies were available to the team.) The World Bank Agriculture Sector Memorandum, for example, identifies research, extension, transportation, and marketing as all being "priorities," and makes no attempt either to quantify or to rank them as constraints.

Data Limitations and Requirements

The principal reason why no such quantitative ranking is possible is the severe lack of appropriate data. The only significant source of available data is the 1984 Agricultural Census. The census is rich in data regarding average farmgate prices, areas planted in various crops, yields, and quantities harvested and sold. Yet, the census does not provide sufficient information with regard to marketing and transportation to assess quantitatively the extent to which marketing and transportation impose constraints on sector growth. (The World Bank cites a ". . . nearly absolute absence of regular information at the intermediate market level.")

The 1984 census also fails to distinguish between varieties planted in each crop. Thus, the census provides no basis for assessing the contributions of the NCRE project. Moreover, the evaluation team's visits to several provinces suggested that the existing data is not well disseminated throughout the country.

The types of data required to undertake the analysis called for above would include detailed information regarding the composition of marketing margins: transportation, storage, and processing costs, handling charges and residuals accruing to traders, as well as farmgate, whole, and retail price series. Bribes to policemen at roadblocks are also said to contribute to marketing costs, and data on those transactions would also be relevant. Other data necessary to undertake such an analysis would include road construction and maintenance costs, results from the demand study and market monitoring system planned for USAID's Fertilizer Sub-Sector Reform Program, adoption rates of new technologies, and the cost of extension services. In the absence of these sorts of data, it is not possible to quantify the net returns to investments in the areas cited above.

Rice was the only commodity for which adequate data was available to undertake an analysis of the relative importance of research versus marketing as a constraint.

Rice

Rice production and marketing is widely recognized as a special problem within Cameroon's agricultural sector. Although no specific quantitative analysis has been done, it is fairly clear that Cameroon currently does not enjoy a comparative advantage in rice production. The question of whether or not Cameroon should produce rice, however, falls well beyond the scope of the NCRE evaluation. The appropriate question for this report is whether, or to what extent, NCRE funds should be allocated to support rice research.

As stated in the recommendations, the team's conclusion is that a lack of production technologies is not the primary constraint on rice production and marketing. The rice research program should not be a high NCRE priority. Reliable information on the cost of rice production is scant; yet, a rough analysis of available information suggests that if significant gains are to be made toward making domestic rice competitive with imported rice, most of those gains will come in the area of post-harvest handling and marketing (which includes transportation and processing).

This conclusion follows from an decomposition of the retail price of domestic rice in Douala/Yaounde. The first stage in this decomposition is to distinguish between production and marketing costs. The retail price of domestic rice in Douala is approximately CFA 220/kg. Available estimates of the on-farm production cost range between CFA 65/kg and CFA 72/kg, which implies marketing costs (including storage, processing, and transportation) of approximately CFA 150/kg. The ex-factory price of SEMRY rice is CFA 180/kg, to which one must add CFA 40/kg for handling and transportation to Douala. The cost of paddy entering the SEMRY mill would be CFA 90/kg if they purchased it at the official price of CFA 78/kg, plus what they report to be CFA 12/kg for transportation to the mill. This implies a processing and handling cost of CFA 90/kg at SEMRY, which is consistent with the cost reported at UNVDA.

In contrast, imported rice lands in Douala at CFA 80-90/kg and retails at approximately CFA 120/kg. If the GRC were to impose import tariffs to compensate for what the World Bank estimates to be a 30 percent over-valuation of the CFA, that would raise the retail price of imported rice to nearly CFA 160/kg. Taking the SEMRY processing and transportation cost of CFA 130/kg as given (40 for transportation plus 90 for processing), SEMRY would have to be able to purchase paddy for CFA 30/kg in order to be competitive with imported rice. Subtracting CFA 12/kg for transportation to SEMRY would require that farmers be able to produce rice at no more than CFA 18/kg, which is clearly far beyond any realistic expectation from agronomic research. (At current production costs/ha reported in Ndop Plain, yields would need to increase from 3.6 tons/ha to over 18 tons/ha to result in a unit production cost of CFA 18/ha.)

Comparison of Per Kilo Costs: SEMRY vs. Imported

	SEMRY	Imported	
On-Farm Production	70		
Paddy Cost at SEMRY	90		
Processing & Handling	90		
Ex-factory	180	90	c.i.f. Douala
Transport	40	30	port fees, mktg mrg
Retail	220	120	

In short, it is virtually inconceivable that agronomic research alone could reduce unit production costs sufficiently to make local rice competitive with imports, given the current domestic marketing situation (though one could expect that any shift in relative prices in favor of domestic rice would increase its demand and thus help to dig SEMRY out from under its famous mountain of 60,000 unsold tons).

These calculations are uncertain and are not intended as a rigorous examination of the economics of domestic rice; yet, they are broadly illustrative of the magnitude and nature of the problems confronting the Cameroonian rice industry. An optimistic assessment of the potential unit cost reduction from agronomic research is on the order of 10 percent, and operations research on improved organization of production might reduce production costs by 20 percent beyond that. The above calculations demonstrate that a production cost reduction of that magnitude would be a relatively small victory in the war against imported rice. Any major gains must come on the marketing side.

Further suggestion that a significant part of the problem stems from exaggerated marketing costs lies in the fact that small-scale private rice processors in the SEMRY region are able to purchase paddy at CFA 50/kg and (despite milling ratios of only 50 percent) sell finished rice at CFA 133/kg. Thus, the small-scale private mills are able to produce finished rice at a price 26 percent below SEMRY. Nonetheless, adding CFA 40/kg transport still puts the c.i.f. Douala cost of the privately milled northern rice at CFA 173/kg, roughly 42 percent above the current retail price of imported rice. This example demonstrates the significance of transportation costs as an impediment to SEMRY rice sales in the large urban markets.

Short grain length and poor milling quality are also serious problems for the local rice industry. The varieties produced on the Ndop Plain and at SEMRY are short and chalky. Lots with variable moisture produce brokens and poor surface appearance when milled. Thus, even in the Ndop region (that is, with minimal transportation costs), consumers tend to prefer longer grain, translucent polished rice that is imported, despite a 20 percent cost advantage for local production. The issue

of grain quality improvement should be a top priority for the rice variety research activities.

With regard to the more general question of where lack of technology development ranks alongside marketing, transportation, extension, pricing, and so forth, as a constraint to growth, one is left with no directly useful data and no particular qualitative methodology to respond. At this point, the only guidance comes from a subjective zone-by-zone survey of the relative condition of each of these factors. In the North Province, for example, roads, inputs, and extension are all reasonably adequate. In those circumstances, the returns to investment in research may be quite high, since the complementary factors are in place.

In the North West Province (NWP), maize yields are already reasonably high (in some instances approaching three tons/ha). Yet, interviews in that region suggested that serious problems exist in evacuating produce to markets. Thus, the returns to improvements in transportation may be high relative to returns to research in NWP. One should note, however, that the maize research conducted in NWP also supports production in Adamaoua and other regions in which maize production is rapidly expanding.

Roads in the South West Province (SWP) are in generally better shape than those in the North West, and SWP has certain specialized research needs for Cassava and tuber-based systems. Thus, research may be a higher priority than roads in SWP. In any discussion of investments in roads, however, one must bear in mind the high recurrent costs of road maintenance.

Unfortunately, this level of analysis is far too partial and subjective to guide future USAID rural sector interventions. As noted above, the relative ranking of constraints to rural development is an important and complex question. A rigorous answer will require a substantial effort at data collection and a separate study of considerable magnitude.

Consistency of GRC Policies with Research Initiatives

The question of whether the GRC's research priorities are consistent with its other agricultural policies regarding input and output marketing, pricing, seed multiplication and delivery, and road construction must take as its starting point that the GRC is actively engaged in an agricultural research agenda and will continue to be. The question then becomes whether or not those other elements are consistent with the agricultural research program.

With regard to input marketing, the GRC (with the assistance of USAID) has recently undertaken a broad-based program to liberalize fertilizer marketing. In principle, higher fertilizer costs (holding farmgate prices constant) would reduce the net benefits of adopting improved technologies. However, under the previous system of subsidized public-sector fertilizer delivery, little fertilizer was delivered, and the range of fertilizers available was narrow. Nearly all of the fertilizer available was delivered through parastatals responsible for specific cash crops, and any fertilizer

applied to foodcrops was diverted from cash crops. Thus, fertilizer formulations appropriate for foodcrops were generally not available, reducing the efficiency of fertilizer use.

If the new fertilizer policy succeeds in making fertilizer more widely available, then on balance it will support the research agenda. Casual observation at each of the TLUs, however, tended to indicate that to date there has been no significant increase in the availability of fertilizer, despite the reduction in subsidies. Part of the explanation for this may also be a lack of effective demand, as the fall in cash crop prices has reduced farmers' cash incomes, and little credit is available to small farmers outside the parastatal networks.

On the output side, the GRC appears to have no policy with regard to food crop pricing and marketing. In principle, the Office Cerealier acts to stabilize foodcrop prices through buying and selling operations. The Provincial Delegate of Agriculture in Garoua indicated that they were moving to adopt a system of floor and ceiling prices. Their intention is to purchase 20 percent of marketed cereals production. In practice, the resources available to the Office Cerealier to undertake these operations are so negligible as to make the policy itself nonexistent.

In principle, a food-pricing policy consistent with the objective of fostering adoption of new technologies would be one that moderates highly variable food prices. Indeed, the economist at Maroua cited high seasonal and yearly price variability as a significant constraint to the adoption of new technologies by risk-averse farmers. Under present circumstances, however, the GRC is probably unable to implement such a policy.

The GRC has avoided the common policy mistake of taxing foodcrop producers in order to subsidize urban consumption. In that respect, the GRC's foodcrop pricing policy supports its agricultural research initiatives. One should note, however, that the over-valuation of the CFA works to the detriment of domestic food producers by making imported foodstuffs artificially cheap.

The existing seed multiplication and delivery system is clearly inconsistent with the GRC's research initiatives. Although a detailed evaluation of the seed delivery system is inappropriate here, one can say that the system's performance to date has been extremely poor. For whatever reasons, MIDEVIV and Projet Semencier have been unable to maintain their link in the broader agricultural research and extension system. Widespread adoption of technologies developed by NCRE and IRA will be impossible without a functional seed multiplication and delivery system.

The economist's scope of work raises the question of the NCRE project's contributions to date on economic growth. This question is unanswerable due to the fact that the structural linkages between agricultural research and economic growth are highly indirect. Any quantitative answer to this question would be built almost entirely on vague assumptions. What can be said, however, is that research helps to create the conditions under which agriculture can contribute to sustained economic growth. The NCRE project clearly has contributed to growth in at least that limited respect.

Research Costs and Benefits

As noted above, the extreme lack of relevant data severely limits an economic analysis of the NCRE project. At his, stage, there is no basis for quantifying the benefits resulting from USAID/IRA research investments. Indeed, as the financial analysis section notes, generating even the cost data is a formidable task which is not yet entirely possible. This type of cost-benefit calculation is the object of a two to three year effort currently underway by ISNAR. This section of the analysis describes the strengths and weaknesses of the ISNAR cost-benefit model.

The ISNAR cost-benefit methodology consists of an elaborate spreadsheet model designed to assist in the prioritization of research investments. The model's application proceeds in three stages: 1) rate of return analyses for each of the research types yielding cost-benefit ratios and internal rates of return, 2) a ranking of research types based on one of those criteria, and 3) sensitivity testing of each component of the preceding analysis.

One strength of this model lies in the process required for its application. The model requires detailed estimates of the costs of each research activity over a multi-year horizon. If data collection is taken seriously, it will force IRA systematically to assess the costs of each of its research initiatives. Another strength of the model is that it emphasizes the long-run nature of the returns to research investments and the effects on the returns to investment of alternative present research strategies. This is a useful educational point both for scientists and for research managers. In these regards, the ISNAR model has the promise of being a useful planning exercise. Yet, the model is not without weaknesses.

Among the model's greatest weaknesses is the magnitude of the assumptions required to calculate net benefits. These assumptions include: duration of research, probability of success, marginal on-farm costs and benefits per hectare, the rate and timing of adoption by farmers of the technology in question, the ultimate ceiling on adoption, and the life of the innovation. The model does incorporate extensive sensitivity analysis of these parameters, and ex-post studies of earlier technology introductions could make the assumptions more realistic. Nonetheless, the fact that simultaneous assumptions are required of all of them suggests that the model's results should be taken as illustrative rather than definitive. This point is reinforced by the difficulties to be expected in obtaining accurate and detailed estimates of the costs of research.

Although the model's authors correctly stress that the appropriate inputs to the model should incorporate "social" prices (that is, what society forgoes when choosing to produce a given commodity instead of others), actual determination of those opportunity costs is not a simple process. In practice, it is more likely that the model will be run with financial costs, which limits the results to calculations of private rather than social (or economic) returns.

A further limitation of the model is that it is designed to answer only a specific type of question regarding the comparative costs and benefits of alternative research investments. The model does not directly address questions relating to the country's comparative advantage in producing various commodities, and its implications for setting research priorities. For example, yield increases in rice have been high, and adoption rates through the rice parastatals have approached 100 percent in irrigated perimeters. An application of the ISNAR model to investments in rice research might indicate an extremely favorable benefit/cost ratio. Yet, as described in detail above, the are serious reasons of which the model takes no account why rice research should not be a high priority.

Although the process of gathering cost data for the model is cited above as a positive contribution to IRA planning exercises, the extent of the data requirements, and the sensitivity of the model's results to the accuracy of that data may ultimately be the model's greatest weakness. The effort required to satisfy the model's full data requirements goes beyond the accounting procedures recommended in the financial analysis section of this evaluation. In terms of the resources that will be required to implement the model, it may well be the case that the cost of the model itself exceed its benefits as a planning tool.

ISNAR is currently implementing its cost-benefit model with financial assistance from the World Bank. If ISNAR is successful in overcoming the obstacles to implementing its model, it could provide an interesting contribution to IRA and NCRE planning activities. Yet, as a matter of prioritizing the efforts at prioritization, NCRE should expend no more resources on the ISNAR model than would otherwise be required by the new financial accounting system planned for the project.

Research Design

An economic assessment of the NCRE research design addresses two questions: 1) does the allocation of NCRE project resources among crops reflect the relative economic importance of those crops; and 2) within each commodity program, is the emphasis on varietal development relative to agronomic and other practices appropriate. This section does not address the question of whether the aggregate size of the NCRE project is appropriate. Economic judgement in that regard must come from an economic impact assessment of the project, the feasibility of which is discussed in the following section. However, the appropriate aggregate size of the project is only partly an economic question. The sections of the evaluation that address the breeding, agronomy, and TLU activities each suggest ways to streamline the project, and those suggestions are summarized in the main body of the report.

With regard to commodity selection, the breeding and agronomy programs (for which approximately two-thirds of the NCRE budget was allocated) have placed approximately half their resources in maize, and divided most of the remaining half more or less evenly between rice and sorghum/millet. (The cropping systems in the Ekona region are root and tuber based, and the systems in the north include cowpeas and groundnuts. Thus, those commodities have received at least some attention in the farming systems work.)

The first question is whether this allocation of research resources makes sense in the context of Cameroon's agricultural economy. The approach taken in this analysis is to compare the project budget allocations for various programs with an assessment of relative economic importance of each crop (though this assessment is limited by data availability). Maize is the most widely grown and consumed crop in Cameroon. Maize is also grown under a wide range of agro-ecological conditions, requiring a large-scale research effort. In terms of comparative advantage, maize production also appears to be an efficient allocation of productive resources (though no formal study of comparative advantage has been done). Thus, the project's allocation of half of its breeding and agronomy resources is justified. It may be appropriate, however, to shift maize research resources somewhat toward the northern zones in view of the rapidly growing economic importance of that crop in those regions.

In contrast, rice appears to have been over-emphasized in NCRE research activities, relative to its economic justification. Rice is grown on only 14,000 hectares, and less than one percent of the population is engaged in rice production (though within the northern zones the proportion is higher). Moreover, as discussed above in greater detail, Cameroonian rice producers are sorely unable to compete with imported rice, which is both less expensive and of better quality.

From a political economic perspective, however, the problem of rice is complicated by the fact that most rice producers are almost entirely dependent on rice for their income. The GRC made the decision to create rice production zones as a vehicle for integrated rural development, with apparently little consideration of whether rice production would ever be economic. The crisis has undermined the GRC's ability to continue to subsidize rice production. Yet, there may be 30,000 people left with little alternative to rice production. As long as this remains the case, it is incumbent upon the GRC to maintain at least a minimal level of research support for rice production. The team feels that NCRE should contribute to this effort, but on a reduced scale relative to the previous project allocations made to rice research.

Sorghum and millet research effort levels have been roughly in line with the economic importance of those crops. The northern zones are primarily sorghum/millet-based systems. However, some of the sorghum research activities have been allocated to the Adamaoua region, where that crop plays a much less significant role economically.

In terms of income generation in the northern zones, sorghum and millet are less significant. In the Extreme North, only 3.5 percent of sorghum/millet is marketed, and only 6.4 percent in the North. In those regions, cotton, groundnuts, and cowpeas are the primary source of cash income. For example, in Adamaoua, 64 percent of total cowpea production is marketed (though the figure is closer to one-fifth for the two northern zones). Approximately one-half of total groundnut production is marketed in the two northern zones and Adamaoua. Thus, from the perspective of promoting income generation, it appears that those crops may have been relatively under-emphasized.

The second type of question relative to an economic assessment of the NCRE research design pertains to the research emphasis within each commodity. Yield-oriented varietal research has strongly dominated the NCRE work plan. Of course, this emphasis was the only one possible in the project's earlier stages. Yet, now that varietal development is well under way in most commodities, the economic imperatives point more towards an emphasis on post-harvest handling, agro-industrial utilization, quality improvement for certain commodities, and soils management.

From an economic perspective, improved storage technologies stand out as the most immediate need. The prospect of either greatly increased storage costs or greater post-harvest losses poses a significant threat to the long-term economic viability of these crops. The storage technology needs are not limited to any particular crop: each of the TLU's visited by the team cited inadequate storage as a primary concern (though this was less true for sorghum and millet in the north). Greater NCRE attention to storage is highly justified, and should address both the storage characteristics of the varieties and the storage technologies themselves. TLU/Ekona has been particularly sensitive to the latter concern.

With regard to agro-industrial utilization of improved varieties, research might now address such possibilities as the use of maize and sorghum flour as a partial substitute for wheat flour, improved amylase activity to facilitate the use of domestic maize and sorghum in beer production in place of imported grains, and an orientation towards more convenient consumers food products for urban markets.

A visit to the main brewery in Yaounde revealed that the primary constraint on the use of local maize in beer production is a lack of available supply. This is primarily a marketing issue, since less than one-fourth of total maize production is marketed, and the breweries are only interested in purchasing grits. At this time, MAISCAM is the only company capable of providing significant quantities of processed grits to the breweries, and the only economically viable distribution point is Yaounde.

The Brasseries du Cameroun, which is only one of several large brewing companies, consumes 25,000 tons of grits per year (equivalent to 45,500 tons of unprocessed maize). Yet, MAISCAM is able to supply only 7,000 tons per year, all of which is purchased by Brasseries du Cameroun despite a 15 percent price advantage for imported grits. The brewery indicated its willingness to purchase whatever quantity of domestic maize grits is available, provided it is of acceptable quality and not too much more expensive than imported grits.

Quality improvement is more imperative for some commodities than others. Rice stands out as a prime candidate for quality improvement. Rice yields have increased significantly; yet, consumers are willing to pay a higher price for superior quality imported rice in some regions. Domestic rice is unlikely ever to be competitive with imported rice without significant gains in quality.

Soils management, which is discussed at length elsewhere in this report, also has important economic implications. The long-run sustainability of present research

gains rests ultimately on the continuing ability of the soil to support intensive production. Calculations of the long-term returns to investments in agricultural research (that is, the ISNAR cost-benefit model discussed above) assume the sustainability of yield improvements. If insufficient attention to soils management eventually undermines those improvements, the returns to agricultural research could fall far short of their potential.

In short, economic considerations regarding adoption incentives, the sustainability of research gains, and long-run returns to research investments all suggest a shift in the emphasis of future NCRE research activities away from yield-oriented varietal development towards the areas cited above.

These alternative research emphases are particularly relevant to gender considerations in the NCRE research design. It is well known that in most regions of the country, women dominate the production, processing, and post-harvest handling of foodcrops. Greater consideration of this fact needs to be embodied in research plans in these areas. For example, TLU activities to channel farmer feedback into research should target women. TLU/Ekona was the only location where this question was given full consideration.

Farm Budget and Economic Impact Analysis within the NCRE Project

To date there has been a disappointing lack of economic analysis performed by the NCRE project. This lack is primarily a function of the staffing pattern of the project, however, and does not reflect upon the quality of the analyses that have been done. The TLUs at Bambui and Nkolbisson have had economists on staff since early in the project. They have engaged actively in the programs of those TLUs and have produced generally high quality analyses of agronomic trials. Indeed, the economist at Nkolbisson has recently produced an analysis of fertilizer application trials that employed a highly innovative economic methodology.

In contrast, no economic analyses whatsoever have been done at TLU/Maroua. A highly qualified economist is now assigned to that station, but he only arrived five months ago and cannot yet be judged. The TLU at Ekona has undertaken economic analyses, but the process there has been more ad hoc. TLU/Ekona does not have a trained economist, and the anthropologist who has undertaken the economic analysis is heavily burdened by survey and extension activities.

One must assess the feasibility of the NCRE project's conducting farm budget analysis to measure the economic impact of improved technologies in light of the methodological distinctions between different levels of farm budget analysis. The objective of moving from the simplest to the most complex analysis is to move from calculations of private profitability to social profitability (for example, economic analysis). The simplest level of analysis involves the calculation of partial farm budgets.

Partial farm budget analysis is used to estimate the profitability of relatively small changes on an existing farm. This is precisely the type of analysis appropriate

to assess the marginal change in farm income from the adoption of, say, an improved maize variety in place of an existing traditional variety. If the sum of costs saved plus new revenue exceeds the sum of new costs plus revenue foregone, and the change is technically feasible, the new enterprise is justified.

Nearly all of the economic analyses performed to date by the NCRE project have been partial farm budget analyses (with associated net benefit curves in some instances). The data requirements for this type of analysis are quite modest and it costs little to implement. Partial farm budget analysis is thus well within the financial and technical means of the TLU-based NCRE economists.

Partial farm budget analysis, however, does not address the economic impact of technical change. It's findings are limited to marginal changes in farm income, and it is appropriate only for small changes in farm activity. The next level of farm budget analysis is an intermediate step between the partial analysis described above and a full economic analysis.

This level requires the calculation of full farm budgets, based on an aggregation of all farm enterprise budgets. Enterprises are defined as the various subdivisions of the farm (for example, livestock might be one enterprise and a mixed maize/groundnut field another). Full farm budgeting is a highly data-intensive exercise, particularly with regard to labor data. The implementation of this analysis requires extensive and detailed surveys of all farm enterprises. It is an expensive and time consuming process, which is more descriptive than analytical. Thus, the feasibility of full farm budget analysis is significantly more limited than that of partial analysis.

The agronomist/economist at TLU/Bambui has undertaken such analysis at great time and expense. He is to be commended for the quality and thoroughness of his effort. Yet, the entire effort was expended on a sample size of 24 farms. Thus, it is not clear that greater efforts along these lines are a cost effective use of his time, if the technical changes expected in that region are sufficiently marginal as to be appropriate for partial budget analysis. The economist at TLU/Maroua also has initiated plans for survey work of this type. Such activities in the north should be concentrated in those geographic zones where the TLU is capable of having its greatest impact.

The types of budget analyses described above are the components of a broader financial analysis of the NCRE project which compares the farm-level net benefits with and without the project. A true economic analysis of the improved technical packages developed by the NCRE project would precede from an aggregation of the financial analysis, which is then adjusted in several ways to depict real resource flows, including the costs of research, extension, and training. In this aggregation of enterprise budgets, the level of technology adoption will be the critical variable that influences the economic returns to the project.

A methodologically valid economic impact assessment of the NCRE project is not yet feasible. As described above, an economic impact assessment is done by aggregating a sample of full farm budget analyses; yet, to date only one such

analysis has been performed. The time and expense required to replicate that effort throughout the provinces in which NCRE operates exceeds the resources available for that purpose. Thus, a high priority for the TLU coordinator should be to devise a methodologically valid means of acquiring the necessary information that is also feasible within limited staff resources.

It is also premature to undertake a full economic impact assessment of the NCRE project because of the role that adoption levels play in the aggregation of farm budgets. The data necessary for construct those budgets does not yet exist, nor has adoption yet advanced to a stage at which the true benefits of the project will be reflected. One could make projections regarding adoption levels, but calculations using those projects should still be based on actual farm budget data. That data does not yet exist in sufficient depth.

To the extent that it is feasible for the NCRE project to engage in sophisticated economic analyses, one must recognize that it is a capability that needs to be developed over time. The capability to undertake this level of analysis did not exist within the project until the arrival of the TLU coordinator in late 1988. He has expressed his intention to work toward more extensive economic impact analysis of project accomplishments, and the evaluation team strongly endorses this intention.

The aggregation required for this analysis dictates that it be done from a centralized institutional base. Indeed, this is part of the basis for the team's recommendation that the project establish within IRA headquarters the capability to undertake economic analysis. Over time, USAID might consider shifting the TLU coordinator's terms of reference to enable him to participate more directly in establishing this capability within IRA.

Economic Analysis Capability within IRA

The IRA Action Plan calls for the addition of two agricultural economists in the Research Division to assess: research priorities, food security strategies, the distribution of benefits of new technologies, demand for various commodities and technologies, and agricultural marketing structure and efficiency. The Action Plan further stipulates that one of the economists should be a specialist in research systems management and the other a specialist in agricultural policy and marketing.

While the evaluation team support the notion of strengthening IRA's capability to undertake economic analyses, the suggestion in the Action Plan for a minimum of two positions seems excessive. For example, food security strategies are not primarily an agronomic research issue, and it would be inappropriate for IRA to devote significant resources in that area. Further, research systems management is not clearly the role of an agricultural economist. Yet, the need does exist within IRA for the capability to assess research priorities (which subsumes the demand for various commodities and technologies) and analyze the agricultural policy and marketing environment.

The primary role of an economist within IRA headquarters would be to interpret the implications of the agricultural policy and the marketing environment for research prioritization. This recommendation is the logical conclusion of the suggestion made throughout the evaluation to infuse the project with greater rationalization of its activities by economic criteria.

Creating this capacity within IRA would not duplicate existing capabilities elsewhere. A centralized focus on the economics of agricultural research and the ability to institutional that capacity within IRA does not exist within the GRC. There is also good reason to doubt whether the Cameroon Agricultural Policy and Planning Project can accomplish this task for IRA. The CAPP staff includes only two economists, one of whom is assigned to the Ministry of Livestock. That leaves the remaining economist (who is based in MINAGRI) to take responsibility for pricing policy, agricultural trade policy, export crop studies, and so on. Since agricultural research does not fall within the responsibility of MINAGRI it is unlikely that economist will be able to devote much time to agricultural research issues. There is also some question as to how the CAPP project will divide its emphasis between performing policy studies and concentrating on institution building within those ministries where they are assigned.

In contrast, institution building in IRA is the responsibility of the NCRE project. The question of whether establishing this capability within IRA requires a full-time expatriate technical assistant is left for USAID to decide, but the team strongly endorses the notion of institutionalizing IRA's ability to employ economic analysis in setting its research priorities.

ANNEX F

FINANCIAL ANALYSIS

ANNEX F

PURPOSE OF ANALYSIS

This analysis addresses the questions posed in the Scope of Work (SOW) in Annex A. In brief, these questions concern shortfalls in the Institut de Recherche Agronomique's (IRA) coverage of National Cereals Research and Extension Program (NCRE) project operations and recurrent costs, as per the Loan and Grant Agreement, and their implications for the life of the project (LOP), and beyond USAID phase-out in 1994. The analysis attempts to quantify these shortfalls and recurrent costs, and assess how changes in research priorities, and project management can reduce the recurrent cost burden to USAID and the government of the Republic of Cameroon (GRC) while increasing effectiveness. In addition, the analysis comments on the project management response to the recommendations of the USAID/RIG and IITA/Price Waterhouse audits.

SOURCE OF INFORMATION

From NCRE, IRA, and ISNAR, the analyst drew upon NCRE Annual Work Plans for 1988-89 and 1989-90, the ISNAR "Analysis of Structure and Management of the Institute of Agricultural Research (IRA) and the Institute of Animal Research (IRZ)," and the May 1989, "Action Plan for restructuring and Reprogramming the Institute of Agronomic Research for budget information." Cost reports produced by IITA and IRA administrations at IRA headquarters at Nkolbisson were a source for contract and Special Account facility expenditures.

From the World Bank, the "Agricultural Sector Review" for Cameroon and various internal memos provided an economic background and insight into IBRD's proposed strategy in structural adjustment.

From USAID, the Loan and Grant Agreement, Project Papers (PPs) for Phase I and II, the Phase I Evaluation, memos between AID and NCRE, internal memos, audit reports from RIG and Price Waterhouse, and project budget tracking reports and payment vouchers from the Controller's office furnished a background and numerical quantification from AID's side.

The analyst accompanied the other evaluation team members to interviews with researchers, with NCRE and IRA staff, and with persons from other agriculture-related organizations, and he conducted his own interviews with individual researchers, the project management, and NCRE/IRA and ISNAR staff. These interviews were valuable in assessing the kind and quality of financial information available; the process used collecting, accounting, and analyzing this information in the field and at the head office in Nkolbisson; and translating this into budget and financial management decisions.

Comments on Sources of Information

While project staff, with some exceptions, fulfill satisfactorily the responsibility for reporting line-item expenses of researchers to Nkolbisson, and from there to USAID, it is apparent that project management has not established a formal management information system to collect financial information on the specific researcher activities specified in the Annual Work Plan and feed this back into the decision-making process.

Imprecision in the accounting system for project expenditures under the IITA contract constituted one of the major conclusions of the Price Waterhouse audit nine months ago. For the financial analysis, this shortcoming hindered the analyst in compiling accurate data for his analysis. Spreadsheets contained mathematical errors and accounting showed large entries in "miscellaneous" and "other" accounts. Purchases made in Nkolbisson for research purposes were unallocated to particular research operations. Reporting expenses at the field level for IITA expenses and for IRA/USAID Special Account funds requires researchers to code expenses from two systems that have duplicate line items.

Lack of a management information system (MIS) prevented the analyst from conducting a rigorous comparison of work plan budget for specified research activities versus the actual expenditure variances which would be extremely useful in budget control, priority setting, and decision making in a national program.

Financial information on broad line-item expenditures from USAID and from the project sketched a picture of overall sources and uses of funds and was useful in reconstructing spending at a program and research operation level. It is difficult to reconcile project accounting and AID's project tracking figures because they work on different bases, are designed for different purposes, and span different accounting periods. Within AID's accounting on NCRE, for example, are salaries and expenses that do not show up on IITA's books.

Project funds flow from several sources into NCRE programs: from USAID through the IITA contract and the USAID Special Account facility, and from GRC/IRA for salaries of IRA researchers and staff attached to the NCRE project, and from other, research operation-specific, donor funding such as in roots and tubers and cowpea research. Consolidating these funds, at least at a NCRE research operation level, was a major task in the analysis.

Definition of terms. (Please refer to the NCRE Annual Work Plan.) It is useful to view the various components of NCRE in a tree diagram:

I. "Project": Refers to NCRE.

   A. "Program": Refers to one of the research emphases, such as Maize Research throughout NCRE.

i. "Sub-Program": Refers to a particular agro-ecological zone, such as "Highland Maize" which involves the efforts of a breeder and an agronomist.

(1) "Research operation": Refers to a particular individual or team, such as "Highland Breeder," or "Ekona Testing and Liaison (TLU) Team." Each Research Operation is described in the Annual Work Plan. (ISNAR would refer to this as a research "theme.")

(a) "Research Activity": Refers to the activities that are budgeted as line items under "Research operation" in the Annual Work Plan.

BACKGROUND, PROJECT STRUCTURE, AND THE ECONOMY

Background and the Economy

The Phase II PP for NCRE, approved in 1984, accepted assumptions about Cameroon's capacity to cover the project's recurrent costs into the future. A year later, collapsing oil and commodity prices slashed Cameroon's export earnings, while domestic spending continued to rise, thereby undermining these assumptions. From 1985 to 1986, ISNAR's analysis shows total IRA budget increasing 15.7 percent. By 1987, IRA could no longer cover its share of the operating costs of the project beyond paying the salaries and allowances of the Cameroonians attached to NCRE. Operating funds of IRA decreased 14.3 percent from 1986 while the investment budget plunged by 48.8 percent.

After some struggle with legal restrictions and policy regulations, the USAID Mission undertook to pay the operating costs of the project which were the contractual obligation of GRC as specified in the Loan and Grant Agreement of February 24, 1985.

Using at first a fixed amount reimbursement (FAR), the AID Mission Director authorized a transfer of funds from the project to IRA to cover the operating costs of the agricultural research conducted by the technical assistants and their staffs on NCRE. These expenses not only included inputs such as fertilizer and chemicals used in test plots, labor and simple tools, fuel for IRA vehicles and maintenance, but the travel per diem of the Cameroonian research counterparts, assistants, staff, and drivers. USAID's supplements, considering that the GRC was in technical default of the contract, allowed NCRE to continue its work, while research on other IRA programs sharing the same physical infrastructure in centers and stations slowed considerably.

USAID replaced the FAR facility in May of 1988, in favor of the Special Account facility to be administered by NCRE in Yaounde to reimburse monthly the NCRE researchers for expenditures made for operational purposes.

The Special Account facility, although allowing the NCRE project to progress, raises acute questions about the GRC's capacity to support its foodcrop research programs during LOP and after AID's commitment phases out in 1994. It is worth noting that, with a total combined GRC/USAID funding of more than $64 million, NCRE is the largest project in AID Cameroon's portfolio.

The CDSS projects slow recovery for the Cameroonian economy over the period covering the LOP which could result in some improvement in the IRA budget for NCRE. The World Bank's Cameroon mission feels more pessimistic about the GRC support. In either case, in the short to medium run, USAID confronts: 1) the choice of covering operating costs into the future, perhaps including some Cameroonian salaries now covered by IRA, 2) covering all costs but exacting measures at the project level for cost-control and economy, or 3) doing #1 and #2 while inducing joint and parallel cofinancing for IRA, NCRE, and its separate operations. **The latter scenario implies close donor communication, agreement, and coordination to concur on research priorities with the national program directors, reduce duplication of effort, and to act in concert to control recurrent costs.**

Project Structure and Management

NCRE exists as two of the major IRA cereals and farming systems research programs. Within NCRE are three major focuses: breeding, agronomy, and TLU. IRA itself is situated within MESIRES, the Ministry of Higher Education, Computer Services, and Scientific Research, a situation which tends to complicate project management. The TLUs which link NCRE research and agronomy with extension to farmers, are limited by extension service capabilities. Extension services, however, fall under the Ministry of Agriculture (MINAGRI), which means that the achievement of project goals in terms of benefiting farmers is affected by conditions outside of NCRE's immediate managerial control. Budget slashing in MINAGRI and parastatal organizations is causing the financial status of extension services to deteriorate.

In several regions of the country, the project has addressed the problem of extension by assisting in covering extension service cost. MIDENO in the Northwest, and SODECOTON in the north are prime examples. However, this tendency could, over time, reduce the range of activities TLUs could afford to manage.

The Budget Process

The NCRE budget-setting process involves negotiation between individual researchers and the NCRE project management. The Annual Work Plan expresses the outcome. The NCRE Chief of Party (COP) contends that these specific research activity and operational budgets are derived from analysis of historical spending patterns from prior years, however, it is not clear that the accounting system basis, as observed at Nkolbisson by this analyst and the auditors, can provide the COP with that level of management detail on research activities.

From another point of view, some researchers and staff declared that the costs of all program budgets were scaled in proportion from the budget estimations of the

most expensive breeding program and that the other researchers overstated costs to provide the flexibility to compete in the negotiating process. If this is the case, it is conceivable that specific research activity budgets are grossed-up to sum to the research operation total, or, that activities are planned which would not be undertaken under a more regimented cost environment. (Comparisons between research budget allocations and actual expenditures are treated in a following section.)

The Ekona TLU presented one exception to the top-down budgeting process. The socioeconomist built a model, to compute the cost of research activities under her supervision (see Table 16). The economists at Bambui and Nkolbisson are also using computers to work out their budgets. Thus, zero-based budgeting exists in some parts of the management culture of the project.

Conversations with the newly arrived NCRE deputy chief of party revealed that he was already taking steps not only to vastly improve the accounting system and inventory tracking but to address, in a cost-effective manner, management information systems to assist in tracking costs and inputs to specific, researcher activities.

Priority Setting

The IRA Action Plan of 1989 recommended that a priority-setting exercise proceed based on economic impact of research on farmer productivity. To this end, ISNAR has taken the first steps in applying a cost-benefit analysis to agricultural research, and at the time of the writing of this report, is conducting introductory seminars at Nkolbisson for selected IRA and NCRE staff. (See Annex E, Economic Analysis, for the primary comments on the model as an instrument of priority setting.)

From a capital budgeting and project selection point of view, if a restricted budget is set forth, priority setting may result in a contraction of programs and operations which would liberate funding for other uses, and concentrate funds and attention on operations and activities that have the greatest impact.

On the information management side, this analyst suspects, however, that ISNAR will encounter difficulties in the collection of operations costs, requiring the economists to use approximations. Research activity costing was not observed to exist at the research stations except in an informal proforma state. Project management is aware of this problem and the economist with the Nkolbisson TLU is looking into alternative methods of priority setting.

Financial Management

The head office staff at Nkolbisson consists of an administrator, a position that has rolled over three times in the Phase II LOP, his assistant, a clerk, two data-entry clerks (computer), and a bilingual secretary, all hired by IITA. Two

operating accounts are maintained by the IITA, one for contract funds, the other for Special Account. At stations and centers, researchers maintain a single account, which handles all their research expenses. Researchers sign checks and reconcile their own bank statements.

As the reporting system works, each month a researcher itemizes and codes his expenses either with IITA expense codes, or with the different IRA expense codes for Special Account expenditures, then sends his expense summary to NCRE/IRA headquarters in Yaounde. The NCRE accounting staff receiving the information enter the expenses by the same expense codes on a spreadsheet. Currently, several researchers are sending in their expense reports on computer diskette which expedites the process, both in the field and at Nkolbisson head office, and promotes accuracy.

The following month, the NCRE/IITA researcher receives two checks, one for the IITA contract expenses, and another from the Special Account facility for the IRA expenses, which he deposits into his impress account. The system relies on the responsibility -- and discretion -- of the individual researcher for its integrity in financial management. Except for advice and assistance in handling local contracts and labor, the IRA accounting and finance personnel at centers and stations are bypassed.

As mentioned above, the newly arrived IITA deputy chief of party will be taking part in the financial management of the project. He has begun setting up a DBase accounting system that will simplify the accounting at head office and stations. This will constitute a major step in improving efficiency, but as described the system will not cost-effectively track line-item expenditures against specific operations unless sub-codes fields, representing those researcher activities budgeted in the Annual Work Plan, a management information system will have to be designed to capture the required information. Recognizing this, the deputy chief of party recommended several feasible, and cost-effective MIS approaches. He also presented his design for an accessible inventory system for the stations and centers which will respond to the recommendations of the audits.

The core IITA-USAID financial relationship is managed from IITA headquarters in Ibadan, Nigeria.

It is important to prepare Cameroonians to manage the project after AID's phase-out. NCRE's management should make a concerted effort to disseminate accounting and project implementation software and expertise to IRA and the project counterparts. It is conceivable that certain participants now receiving degree training in the United States could be selected for some project management training seminars in addition to their subject matter curricula.

A COMPARISON OF BUDGET AND EXPENDITURES[a]

The NCRE Project Budget

The Loan and Grant Agreement for Phase II approved a total budget for the project of $64,472,000 in which AID would contribute $39,027,000 over the 10-year life of the project, $35,422,000 in grant funds and $3,605,000 in loan. The GRC (MESIRES) participation would equal $25,445,000, or 39 percent of total project budget, where "cash costs" in local currency would amount to $13,596,000, equivalent to 53 percent of its participation and 21 percent of the total life of project budget.

IITA Expenditures under Contract

The AID "Summary Project Financial Report by Project Element" (12 June 1989) breaks out, project to date, broad line-items and amounts. (Refer to Table 1.)

The difference between "Earmarks to Date" and "Expenditures" leaves a positive balance of $6.8 million. The difference between "Commitments" and "Expenditures" is a positive $5.1 million. In addition, AID committed a 10 percent "Contingency" of $2.9 million, 47 percent in local currency, and $10.5 million for "Inflation" in international prices.

The difference between "Commitments" and "Expenditures" is evident primarily in training and procurement, which have both experienced delays. Even though the volume of short-term assistance has been behind schedule, AID shows $6.9 million has been expended to date on technical assistance against a time-adjusted projected amount in the project paper of $6.9 million, exactly on target.

It is noted that although AID's accounting system serves its own internal, project-tracking interests with respect to contract laws and regulations, it is not very useful as a hands-on, project management tool for the reasons cited above in discussion of NCRE/IITA's management information systems. Nevertheless, AID's figures include, in cases such as Cowpea Research, costs that lie outside of the IITA contract, and are therefore not captured by NCRE's accounting system.

Government of Cameroon Expenditures

The GRC, through MESIRES and IRA, has been covering salaries and benefits to IRA counterparts attached to the NCRE project. Unfortunately, at the time of this

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[a] Please note that an exchange rate of $1.00 = CFA 330 has been used consistently to convert from one currency to another.

report, IRA has not yet been able to supply more precise salary information than a list of counterpart salaries, some of which include benefits such as housing, some of which do not. In the analysis of budget and expenditures (below), these numbers were plugged into the analyst's spreadsheets. (See Tables 4 and 5.)

The average salary of the 30 counterparts in NCRE computed on IRA's figures is CFA 3.78 million ($11,500). On this basis, IRA is paying about CFA 113.5 million ($344,000) annually on NCRE counterpart salaries. Since the 14 Cameroonians in degree programs will return to be placed in the project, we can assume another CFA 52.9 million ($160,500) in recurrent salaries for a grand total of CFA 166.4 million ($504,500). The model assumes that the salaries and benefits paid by NCRE to the 29 staff members of CFA 30.5 million ($92,300) are been covered under contract expenses or Special Account funds. The payroll for IRA 18 technicians (CFA 28.1 million), 4 secretaries (CFA 3.1 million), and 2 drivers (CFA 1.1 million), totalling CFA 32.3 million ($97,900) is being picked up by IRA. (See Tables 2 and 3 for research staff.)

It is conservative to overstate the costs rather than underestimate them. Rudolf Content asserted in an interview that his ISNAR team has calculated CFA 7.0 million ($21,000) as best estimate of the cost of paying and supporting a Cameroonian researcher in the field. Plugging this estimate into the model drives the calculation of IRA's annual contribution of salaries and benefits to counterparts to CFA 210.0 million ($636,000). Including the 14 persons being trained in the states which would add another CFA 98.0 million ($297,000), **the conservative total is CFA 307.9 million ($933,000). This will translate directly into recurrent costs of salaries and benefits.**

Relative to IRA's budget projections in the Action Plan, NCRE will then be consuming about 17 percent of IRA's 1992-1993 personnel cost budget of CFA 1.8 billion ($5.5 million).

IRA reports to the analyst that equipment and vehicle investment contributions by GRC to the project were:

CFA 223.4 million ($677.0) in 1985-1986,
CFA 72.9 million ($221,000) in 1986-1987,
CFA 50.0 million ($151,500) in 1987-1988, and
CFA 47.0 million ($142,000) in 1988-1989.

CFA47 million for NCRE investment is only 4 percent of IRA's projected 1989-1990 investment budget, which does not seem to indicate a favored relative position vis-a-vis the other IRA programs.

Taking, then the most recent year as a reflection of future years, Cameroonian salaries and benefits plus investments will range from CFA 245.5 million ($743,900), using the low figures for salaries, to CFA 387.1 million ($1.175 million) using conservative figures. This reflects the expected recurrent costs based on IRA

investment projections and the analyst's calculation of annual salaries and benefits to counterparts. Including expatriates, the salary bill for NCRE would have been $3.0 million in 1988 (excluding trainees and using conservative Cameroonian salary and benefit estimates).

Adding in the 1988 project costs of research operations of CFA 328.2 million ($995,000) derived from IITA and Special Account expense reports, brings total expected recurrent costs to approximately $1.7 million on the low side, to $2.2 million on the conservative side. This is the gap to fill.

NCRE Annual Research Budgets

(Refer to Tables 4 and 5 for summaries of NCRE program budgets and expenditures.) The NCRE research program budget was CFA 168 millon ($509,000) for the 1989-1990 Annual Work Plan. This budget aggregates both IITA contract and Special Account funds from researcher operations and activities and excludes salaries.

The proportions of individual program budgets to the total project research budget and their changes over time indicate relative financial importance. (Refer to Tables 6-15 for detailed budget and expenditure breakouts of NCRE programs and operations.)

The 1989-1990 TLU budget of CFA 63.475 million ($192,300) consumes 37.8 percent of the total research budget followed by maize research with CFA 51.3 million ($155,400) or 30.5 percent. Added together, TLU and maize programs constitute three-quarters of the entire budget, with either of the two greater than rice research and sorghum/millet research combined -- a clear reflection of NCRE programming emphasis.

Within the TLU program, the Maroua sub-program has the largest 1989-1990 budget with CFA 26.7 million ($80,900) or 42.1 percent of total TLU budgets, an increase of 23 percent over the 1988-1989 budget. This is due to SODECOTON's new policy of passing along operating costs of on-farm testing to the TLU. The Ekona sub-program is second with a budget of CFA 17.6 million ($53,300) or 27.7 percent of the total TLU program budget, which showed a contraction of 9.4 percent over 1988-1989. This is perhaps explained by the zero-based budget system the socio-economist showed the analyst.

The ranges between various breeding and agronomy operation budget ratios are wide, but like the other ratio measures, do not necessarily indicate inappropriate proportions. In some cases, the expected value of future benefits is significant enough to justify the disproportions. While the analysis may be appropriate to point out relationships, the number of years under analysis are too few to draw reliable conclusions.

NCRE Research Program Expenses Compared to Budget

The spreadsheet data base and analysis constructed by the analyst compiles expenditures from three sources: IITA expense accounting and estimated staff salaries & benefits, Special Account expense accounting, and IRA salaries to counterparts, trainees, and personnel. The team believes that the estimated salaries of expatriate technical assistants furnished by management are out of date and therefore understated. Consequently, the analyst has used $125,000 per annum across the board as the "Xpat" salary-cost plug. It is suspected, too, that many of the IRA salaries furnished are net of full benefits. Actual expenditures in all programs may be affected by payments made in check from the Nkolbisson for a variety of research purposes. The analyst was informed that these expenditures are not attributed to the various programs.

Net of salaries and administrative costs, research expenses grew 11 percent from 1987-1988 to 1988-1989 at the same time that the total budget rose only 4.5 percent. This may indicate that actual research expenditures are not being translated into budgets. Including administration, 1988-1989 research expenses exceeded the Annual Work Plan budget of research programs for 1989-1990 by 104.2 percent. The program operations spent CFA 154.8 million ($469,000) in 1988-1989, while administration expended CFA 173.6 million or $526,000 for a total of CFA 328.4 million ($995,000) in 1988-1989. The following year's Work Plan, however, budgeted CFA 168.0 million ($509,200) for 1989-1990, 48.8 percent less than the previous year's expenses.

High administrative costs are due in part to payment of TA support expenses and the purchase of materials which the accounting system does not allocate to programs and researchers. In both 1987-1988 and 1988-1989, the ratio of administrative expenses (net of salaries) to research program budgets was greater than one. Since the accounting system does not allocate those parts of the administration budget spent on research materials to the various programs for equipment and supplies, the actual expenses of these programs are probably understated in the sub-impress accounts of the researchers when they are aggregated.

The analyses presented below illustrate some of the spending and budgeting patterns evident from 1987 to 1989. As in the case of budget analysis in the previous section, it is difficult to draw strong conclusions because too few years are available for comparison. In the future, however, it would be useful if NCRE would disclose and explain research spending and budget changes in the Annual work Plan, in a manner seen in most annual reports.

In 1989-1990, cereal agronomy research and sorghum/millet research consumed roughly one-quarter of total research operations spending. The TLU program expanded its 1989-1990 budget 29.1 percent compared to the previous year to CFA 63.5 million ($192,300). 1988-1989 spending rose 51.2 percent compared to 1987-1988 expenses.

Among the TLUs, the Nkolbisson TLU budget expanded 77.2 percent to CFA 13.2 million ($39,400) in 1989-1990, probably due to a combination of the addition of the Ag Economist in late 1988, and the 26.6 percent negative variance in spending over budget in 1988-1989.

The Maroua TLU increased its already ample 1988-1989 budget of CFA 21.7 million to CFA 26.7 million in 1989-1990. In effect, it leapt 382 percent from the smallest 1988 expenditure base of CFA 7.8 million ($23,800), to the largest TLU budget of CFA 26.7 million ($80,900). Maroua TLU, however, underspent its 1988-89 budget by 176 percent, expending CFA 7.9 million ($23,800) against a budget in the same year of CFA 21.7 million ($65,700). As mentioned above, the increase in Maroua's TLU program budget can be partially explained by the necessity to cover the SODECOTON charges. The increase also provides operating funds for the new Extension Economist. In 1989-1990, he anticipates spending CFA 11.3 million ($34,200), or 53.4 percent of the TLU increase over 1988-1989 spending, to describe and understand existing cropping systems and constraints.

The Bambui TLU pulled-in 60.7 percent from its 1988-1989 spending to a modest CFA 6.2 million ($18,800) budget in 1989-1990 even though its spending in 1988-1989 nearly equalled its budget for the same year. This cut-back in the highland maize/TLU group did not happen in isolation. During the same period, the highland agronomist decreased his operation budget 41.1 percent over 1988 expenses, but actually overspent his budget in 1988-1989 by 38.6 percent.

The sorghum breeder increased his budget from 1988-1989 to CFA 12.0 million ($36,500) in 1989-1990 by 14.5 percent and his 1988-1989 spending exceeded his 1988-1989 budget by 37.7 percent. This was attributable to Special Account expenditures.

Status of the Special Account Facility

Corrected NCRE accounting figures show the Special Account expenses for 1987-1988 to be CFA 48.7 million ($148,000), and for 1988-1989, CFA 71.1 million ($216,000). The increase between these years was 45 percent, presumably because, according to NCRE management, IRA operations costs were being picked up by the FAR and by IITA before the establishment of the Special Account facility in 1988.

Given a more realistic growth rate estimated at 7 percent (using uncorrected figures obtained from IITA accounting), and $216,000 as the base, we could expect to see $231,200 in 1989, $247,000 in 1990, $264,000 in 1991, $283,000 in 1992, $302,000 in 1993, and $324,000 in 1994. The sum of $2.02 million since 1987 would be about 30 percent less than the total grant and loan contingency set aside in the Agreement.

Although the difference seems to provide a reasonably safe cushion without taking into account the "Inflation" line-item in the Loan and Grant Agreement, AID should nevertheless attempt to link authorization for disbursement of these funds to efficiency of operations. It is the opinion of the agronomist, plant breeder, TLU

specialist, and the soil scientist on the evaluation team that certain research operations could be eliminated or changed without damaging the research impact of the particular program. Financial implications of these changes will be discussed below in "Indicated changes."

The Cowpea Research Program

The NCRE chief of party requested CFA 8.0 million yearly from USAID in 1989 to finance two research operations in peanut and cowpea. A brief meeting with the cowpea researcher in Maroua, in the company of the evaluation team plant breeder (see Annex I, B/C CRSP-NCRE Linkage) confirmed reports that the program is experiencing serious management difficulties. In short, despite having been advised that the evaluation team would call on him, the researcher was unable to produce any accounting for funds, bank statements, bank reconciliations, or justification for expenses. The researcher declared that he had not been advised of the evaluation team visit and was therefore unprepared. It was observed that technical documentation on operations was lacking as well. From a financial analysis view, it is suggested that AID request a financial review in greater depth than was possible within the parameters of the evaluations teams's scope of work.

Indicated Changes in Staffing and Resource Allocation

1. The evaluation team judges that the Rice Breeder in Dschang should be moved to Maroua where he can have a greater impact. The net cost change is estimated at zero, but the benefit-cost ratio of his activities should increase.

2. TLUs are advised to reduce the expatriate technical assistants to one per TLU, which will affect Maroua and Nkolbisson. The TA savings per year are estimated at $250,000 and the merger of operations could save approximately $50,000 in operating expenses.

3. The rice agronomist position in Dschang should be phased out at the end of the contract, handing the operation over to the Cameroonian Ph.D. recently posted to Garoua. This will yield savings per annum in salary of approximately $125,000 plus annual operating funds from $30.000 to $40,000.

4. The sorghum/millet breeder can be phased out in 1991 for a savings of $125,000 per year, if the detailed phase-out plan in Annex I is followed. Operations should also decrease by 25 percent (about $13,000) through the reduction of research activities as specified in Annex I.

5. These above savings could be reallocated to the recruitment and installation of a soil scientist and lab at Nkolbisson and a Ph.D. counterpart shifted from another IRA program. The estimated cost would be an additional $125,000 in technical assistant salaries, plus about $35,000 in operating expenses.

6. A marketing economist has been proposed as an addition to the technical assistance team based in Nkolbisson to provide a policy perspective and advise IRA and NCRE on the implications for research. If recruited, the marketing economist would add $125,000 to the project in salary and benefits and require operating funds of $40,000.

7. The team suggests that an administrative assistant be recruited for Nkolbisson to concentrate on procurement. This will remove the procurement burden from USAID and will most likely accelerate this neglected area of project implementation. The additional contract costs for a host country national would be less than $10,000 per year.

8. As discussed above, a zero-based budgeting system coupled to a management information system should enforce a discipline on researchers to economize and focus their research operations. Nonetheless, the evaluation team has identified particular activities through which economies can be achieved:

   a. Reduce the total experimental surface area. The Cowpea Research Program, for example, has more than 20 hectares under experimentation. The savings in inputs, labor, per diem and transport costs could be significant without affecting the overall program results.

   b. Eliminate sorghum research activities in the Adamaoua and northern North provinces since these areas are rapidly becoming maize zones. The savings potential could be about $13,000 based on 1988 spending weighted by the 34 percent of time the breeder estimates for these activities. The savings could be applied to defraying the SODECOTON charges for on-farm testing or shifting resources to millet research.

9. The budget for housing should be cancelled due to the favorable change in the availability of rental housing in the vicinity of the stations. Housing at stations should have a lower priority than the construction of research facilities.

10. Construction is behind schedule in the project. A compromise must be negotiated between AID and GRC regulating entities so that infrastructural development can proceed. In particular, seed drying and varietal storage facilities need to be constructed at the breeding stations to protect precious germplasm collections from heat and humidity. The cost of each storage structure is estimated at $200,000.

11. Financial changes resulting from IITA possibly sub-contracting various research programs to other international research organizations is expected to have little net material effect on the entire NCRE project budget. The more important effects would show up in efficiency in training and procurement as mentioned above which might accelerate the uses of funds.

12. Other recommendations with respect to tying the Special Account facility to program and policy changes, revising the accounting system, building an

inventory data base, instituting zero-based budgeting, and analyzing the Cowpea Research Program are treated above in the text.

13. In addition, an IRA Maize breeder has been recommended to be placed in Garoua to assist the Lowland Maize Breeder based in Nkolbisson. Although this could add up to $15,000 in Garoua operating costs, there would be significant savings in transportation and travel per diem.

TABLE 1

USAID Summary Project Financial Report
by Project Element

LIFE OF PROJECT FUNDS ($ 000's)

TOTAL GRANT	35,422.0
TOTAL LOAN	3,605.0

GRANT ELEMENT	OBLIGATIONS TO DATE	EARMARKS TO DATE	COMMITMENTS TO DATE	EXPENDITURES TO DATE	PIPELINE
TECHNICAL ASST	11,058.5	12,288.0	11,152.7	6,896.0	4,162.5
TRAINING	6,470.0	1,087.9	1,070.3	790.3	1,679.7
COMMODITIES	1,896.0	1,502.3	1,105.1	945.4	950.6
OTHER COSTS	996.0	599.0	599.0	203.0	793.0
EVALUATION/AUDIT	183.0	162.2	26.3	25.3	157.7
TOTAL GRANT	16,603.5	15,639.3	13,953.4	8,859.9	7,743.6

LOAN ELEMENT	OBLIGATIONS TO DATE	EARMARKS TO DATE	COMMITMENTS TO DATE	EXPENDITURES TO DATE	PIPELINE
A & E SERVICES	328.0	120.0	81.4	54.5	273.5
CONSTRUCTION	3,277.0	0.0	0.0	0.0	3,277.0
TOTAL LOAN	3,605.0	120.0	81.4	54.5	3,550.5
TOTAL PROJECT	20,208.5	15,759.3	14,034.7	8,914.4	11,294.1

TABLE 2

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RESEARCHERS PAID BY IRA					BUDGET			EXPENDITURES 88-89					
					"A"	"B"	"A+B"	"D"	"E"	"G"	"H"	"I"	"J"
PROGRAM	LOCATION	RESEARCH	STATUS	PAYROLL	1988-89 WORKPLAN BUDGET	ANNUAL ESTIMATED SALARY	"C" BUDGET YR 1989	IITA CONTRACT SPENDING	SPECIAL FUND EXPENDIT	("C+D+E") COST SUBTOTAL	("B+G") OPERATING TOTAL	("A-G") COST VARIANCE	("I/G)* VARIANCE PERCENT
MRU	Nkolbisson	Lowland BreedCAM	IRA		7,400	5,344	12,744	0	5,715	5,715	11,059	1,685	29.5%
MRU	Nkolbisson	Maize breederCAM	IRA		0	5,647	5,647	0	0	0	5,647	0	NA
MRU	Nkolbisson	Maize breederCAM	IRA		0	2,924	2,924	0	0	0	2,924	0	NA
MRU	Nkolbisson	Maize agronomCAM	IRA		0	2,658	2,658	0	0	0	2,658	0	NA
MRU	Nkolbisson	Entomologist CAM	IRA		0	4,038	4,038	0	328	328	4,365	(328)	NA
MRU	Bambui	Maize breederCAM	IRA		0	2,924	2,924	0	0	0	2,924	0	NA
MRU	Bambui	Maize breederCAM	IRA		0	3,704	3,704	0	0	0	3,704	0	NA
MRU	Bambui	Maize agronomCAM	IRA		0	2,924	2,924	0	0	0	2,924	0	NA
MRU	Bambui	Cereals pathoCAM	IRA		0	4,348	4,348	0	0	0	4,348	0	NA
RRU	Dschang	Rice Breeder CAM	IRA		0	5,266	5,266	0	0	0	5,266	0	NA
RRU	Dschang	Rice AgronomiCAM	IRA		0	3,704	3,704	0	0	0	3,704	0	NA
RRU	Dschang	Entomologist CAM	IRA		0	4,254	4,254	0	0	0	4,254	0	NA
CAR	Garoua	Cereals AgronCAM	IRA		0	2,952	2,952	0	0	0	2,952	0	NA
CAR	Garoua	Maize breederCAM	IRA		0	2,924	2,924	0	0	0	2,924	0	NA
SMR	Maroua	Sorghum agronCAM	IRA		0	3,799	3,799	0	0	0	3,799	0	NA
SMR	Maroua	Sorghum agronCAM	IRA		0	2,924	2,924	0	0	0	2,924	0	NA
TLU	Nkolbisson	Extension agrCAM	IRA		0	5,095	5,095	0	0	0	5,095	0	NA
TLU	Nkolbisson	Socio-economiCAM	IRA		0	3,848	3,848	0	0	0	3,848	0	NA
TLU	Nkolbisson	Agro-economisCAM	IRA		0	4,038	4,038	0	0	0	4,038	0	NA
TLU	Nkolbisson	Extension agrCAM	IRA		0	2,658	2,658	0	0	0	2,658	0	NA
TLU	Nkolbisson	Extension agrCAM	IRA		0	4,038	4,038	0	0	0	4,038	0	NA
TLU	Nkolbisson	Agro-economisCAM	IRA		0	3,258	3,258	0	0	0	3,258	0	NA
TLU	Bambui	Exten agronomCAM	IRA		0	5,364	5,364	0	0	0	5,364	0	NA
TLU	Bambui	Agro-economisCAM	IRA		0	2,924	2,924	0	0	0	2,924	0	NA
TLU	Ekona	Extension agrCAM	IRA		0	3,880	3,880	0	0	0	3,880	0	NA
TLU	Ekona	Agro-economisCAM	IRA		0	4,457	4,457	0	0	0	4,457	0	NA
TLU	Ekona	Extension agrCAM	IRA		0	2,660	2,660	0	0	0	2,660	0	NA
TLU	Ekona	Socio-economiCAM	IRA		0	2,924	2,924	0	0	0	2,924	0	NA
TLU	Maroua	Extension agrCAM	IRA		0	4,982	4,982	0	0	0	4,982	0	NA
TLU	Maroua	Agro-economisCAM	IRA		0	2,924	2,924	0	0	0	2,924	0	NA
					7,400	113,384	120,784	0	6,042	6,042	119,426	1,358	22.5%
					$22	$344	$366	$0	$18	$18	$362	$4	

Note: Column F, not shown, is other funds, a total of zero for this sheet.

TABLE 3

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RESEARCHERS PAID BY IITA OR USAID

PROGRA	LOCATION	RESEARCH	STATUS	PAYROLL	BUDGET "A" 1988-89 WORKPLAN BUDGET	BUDGET "B" ANNUAL ESTIMATED SALARY	EXPENDITURES 88-89 "D" IITA CONTRACT SPENDING	EXPENDITURES 88-89 "E" SPECIAL FUND EXPENDIT	EXPENDITURES 88-89 "G" ("C+D+E") COST SUBTOTAL	EXPENDITURES 88-89 "H" ("B+G") OPERATING TOTAL	"I" ("A-G") COST VARIANCE	"J" ("I/G)" VARIANCE PERCENT
ADMIN	Nkolbisson	Chief of Party	XPAT	IITA	0	41,250	128,072	10,443	138,515	179,765	(138,515)	NA
ADMIN	Nkolbisson	Deputy Chief of Party	XPAT	IITA	0	41,250	0	0	0	0	0	NA
ADMIN	Nkolbisson	Admin officer	XPAT	IITA	0	41,250	33,698	1,199	34,896	76,146	(34,896)	NA
MRU	Nkolbisson	Lowland Breeder, xpat	XPAT	IITA	0	0	0	0	0	0	7,400	NA
MRU	Nkolbisson	Lowland Agronomist	XPAT	IITA	15,200	41,250	0	0	0	41,250	15,200	NA
MRU	Bambui	Highland Breeder	XPAT	IITA	24,000	41,250	12,676	9,681	22,357	63,607	1,643	7.3%
MRU	Bambui	Highland Agronomist	XPAT	IITA	8,100	41,250	9,723	3,478	13,201	54,451	(5,101)	-38.6%
RRU	Dschang	Rice Breeder	XPAT	IITA	15,253	41,250	3,615	4,942	8,557	49,807	6,696	78.2%
RRU	Dschang	Rice Agronomist	XPAT	IITA	9,700	41,250	7,245	4,950	12,195	53,445	(2,495)	-20.5%
CAR	Saroua	Cereals Agronomist	XPAT	IITA	6,900	41,250	11,581	2,777	14,358	55,608	(7,458)	-51.9%
SMR	Maroua	Sorghum & Millet Breeder	XPAT	IITA	10,510	41,250	10,679	6,197	16,875	58,125	(6,365)	-37.7%
SMR	Maroua	Sorgh & Millet Agronomist	XPAT	IITA	5,550	41,250	4,339	3,744	8,083	49,333	(2,533)	-31.3%
TLU	Nkolbisson	Nkolbisson: exten agronom	XPAT	IITA	6,300	41,250	3,939	1,542	5,480	46,730	820	15.0%
TLU	Nkolbisson	Nkolbisson: exten economist	XPAT	IITA	0	41,250	3,100	0	3,100	44,350	(3,100)	NA
TLU	Bambui	Bambui: ag economist	XPAT	IITA	10,800	41,250	6,765	4,242	11,007	52,257	(207)	-1.9%
TLU	Ekona	Ekona:socio-economist	XPAT	IITA	6,600	41,250	9,593	1,739	11,732	52,982	(5,132)	-43.7%
TLU	Ekona	Ekona: exten agronomist	XPAT	IITA	12,800	41,250	7,566	2,443	10,009	51,259	2,792	27.9%
TLU	Maroua	Maroua: extn agronomist	XPAT	IITA	21,690	41,250	4,115	3,745	7,860	49,110	13,830	176.0%
TLU	Maroua	Maroua: extn economist	XPAT	IITA	0	41,250	0	0	0	41,250	0	NA
CPR	Maroua	Cowpea Research	XPAT	USAID	0	7,000	0	3,972	3,972	10,972	(3,972)	NA
					153,403	749,500	257,106	65,093	322,199	1,030,449	(161,396)	-50.1%
					$465	$2,271	$779	$197	$976	$3,123	($489)	

Note: Column C. not shown, is the sum of columns A and B.
Column F, not shown, is other funds total of zero on this spreadsheet.

Table 4.

FINANCIAL COMPARISON OF WORKPLAN 89-90 WITH EXPENDITURES 1988-1989.

PROGRAM	RESEARCH	STATUS	PAYROLL	"A" 1988-89 WORKPLAN BUDGET	"B" ANNUAL ESTIMATED SALARY	"D" IITA CONTRACT SPENDING	"E" SPECIAL FUND EXPENDIT	"G" ("C+D+E") COST SUBTOTAL	"H" ("B+G") OPERATING TOTAL	"I" ("A-G") COST VARIANCE	"J" ("I/G)" VARIANCE PERCENT
				BUDGET		EXPENDITURES 88-89					
ADMIN	Chief of Party	XPAT	IITA	0	41,250	128,072	10,443	138,515	179,765	(138.515)	NA
ADMIN	Deputy Chief of P	XPAT	IITA	0	41,250	0	0	0	0	0	NA
ADMIN	Admin officer	XPAT	IITA	0	41,250	33,698	1,199	34,896	76,146	(34,896)	NA
MRU	Lowland Breeder	CAM	IRA	7,400	5,344	0	5,715	5,715	11,059	1,685	29.5%
MRU	Lowland Breeder,	XPAT	IITA	0	0	0	0	0	0	7,400	NA
MRU	Maize breeder	CAM	IRA	0	5,647	0	0	0	5,647	0	NA
MRU	Maize breeder	CAM	IRA	0	2,924	0	0	0	2,924	0	NA
MRU	Lowland Agronomis	XPAT	IITA	15,200	41,250	0	0	0	41,250	15,200	NA
MRU	Maize agronomist	CAM	IRA	0	2,658	0	0	0	2,658	0	NA
MRU	Entomologist	CAM	IRA	0	4,038	0	328	328	4,365	(328)	NA
MRU	Highland Breeder	XPAT	IITA	24,000	41,250	12,676	9,681	22,357	63,607	1,643	7.3%
MRU	Maize breeder	CAM	IRA	0	2,924	0	0	0	2,924	0	NA
MRU	Maize breeder	CAM	IRA	0	3,704	0	0	0	3,704	0	NA
MRU	Highland Agronomi	XPAT	IITA	8,100	41,250	9,723	3,478	13,201	54,451	(5,101)	-38.6%
MRU	Maize agronomist	CAM	IRA	0	2,924	0	0	0	2,924	0	NA
MRU	Cereals pathologi	CAM	IRA	0	4,348	0	0	0	4,348	0	NA
RRU	Rice Breeder	XPAT	IITA	15,253	41,250	3,615	4,942	8,557	49,807	6,696	78.2%
RRU	Rice Breeder	CAM	IRA	0	5,266	0	0	0	5,266	0	NA
RRU	Rice Agronomist	XPAT	IITA	9,700	41,250	7,245	4,950	12,195	53,445	(2,495)	-20.5%
RRU	Rice Agronomist	CAM	IRA	0	3,704	0	0	0	3,704	0	NA
RRU	Entomologist	CAM	IRA	0	4,254	0	0	0	4,254	0	NA
CAR	Cereals Agronomis	XPAT	IITA	6,900	41,250	11,581	2,777	14,358	55,608	(7,458)	-51.9%
CAR	Cereals Agronomis	CAM	IRA	0	2,952	0	0	0	2,952	0	NA
CAR	Maize breeder	CAM	IRA	0	2,924	0	0	0	2,924	0	NA
SMR	Sorghum & Millet	XPAT	IITA	10,510	41,250	10,679	6,197	16,875	58,125	(6,365)	-37.7%
SMR	Sorgh & Millet Ag	XPAT	IITA	5,550	41,250	4,339	3,744	8,083	49,333	(2,533)	-31.3%
SMR	Sorghum agronomis	CAM	IRA	0	3,799	0	0	0	3,799	0	NA
SMR	Sorghum agronomis	CAM	IRA	0	2,924	0	0	0	2,924	0	NA
TLU	Nkolbisson: exten	XPAT	IITA	6,300	41,250	3,939	1,542	5,480	46,730	820	15.0%
TLU	Nkolbisson: exten	XPAT	IITA	0	41,250	3,100	0	3,100	44,350	(3,100)	NA
TLU	Extension agronom	CAM	IRA	0	5,095	0	0	0	5,095	0	NA
TLU	Socio-economist	CAM	IRA	0	3,848	0	0	0	3,848	0	NA
TLU	Agro-economist	CAM	IRA	0	4,038	0	0	0	4,038	0	NA
TLU	Extension agronom	CAM	IRA	0	2,658	0	0	0	2,658	0	NA
TLU	Extension agronom	CAM	IRA	0	4,038	0	0	0	4,038	0	NA
TLU	Agro-economist	CAM	IRA	0	3,258	0	0	0	3,258	0	NA
TLU	Bambui: ag econom	XPAT	IITA	10,800	41,250	6,765	4,242	11,007	52,257	(207)	-1.9%
TLU	Exten agronomist	CAM	IRA	0	5,364	0	0	0	5,364	0	NA
TLU	Agro-economist	CAM	IRA	0	2,924	0	0	0	2,924	0	NA
TLU	Ekona:socio-econo	XPAT	IITA	6,600	41,250	9,993	1,739	11,732	52,982	(5,132)	-43.7%
TLU	Ekona: exten agro	XPAT	IITA	12,800	41,250	7,566	2,443	10,009	51,259	2,792	27.9%
TLU	Extension agronom	CAM	IRA	0	3,880	0	0	0	3,880	0	NA
TLU	Agro-economist	CAM	IRA	0	4,457	0	0	0	4,457	0	NA
TLU	Extension agronom	CAM	IRA	0	2,660	0	0	0	2,660	0	NA
TLU	Socio-economist	CAM	IRA	0	2,924	0	0	0	2,924	0	NA
TLU	Maroua: extn agro	XPAT	IITA	21,690	41,250	4,115	3,745	7,860	49,110	13,830	176.0%
TLU	Extension agronom	CAM	IRA	0	4,982	0	0	0	4,982	0	NA
TLU	Maroua: extn econ	XPAT	IITA	0	41,250	0	0	0	41,250	0	NA
TLU	Agro-economist	CAM	IRA	0	2,924	0	0	0	2,924	0	NA
CPR	Cowpea Research	XPAT	USAID	0	7,000	0	3,972	3,972	10,972	(3,972)	NA
				160,803	862,884	257,106	71,136	328,242	1,149,875	(160,039)	-48.8%
				$487	$2,615	$779	$216	$995	$3,484	($485)	

TABLE 5

(000's) FX 330

BUDGET AND EXPENSE COMPARISONS
AND COMPOSITIONS 1987-1990

		COMPARABLE PERIOD							
(000's)	BUDGET 1987-88	1987-88 EXPEND	<-- % EXP 87-	BUDGET 1988-89	<-- % 88 BUDG	1988-89 EXPEND	<-- % EXP 88-	BUDGET 1989-90	<-- % 89 BUDGET
PROGRAM	BUDGET								
MAIZE	NA	50,010	35.9%	54,700	34.0%	41,601	26.9%	51,275	30.5%
RICE	NA	16,290	11.7%	24,953	15.5%	20,753	13.4%	19,137	11.4%
CEREALS AGRON	NA	12,095	8.7%	6,900	4.3%	14,358	9.3%	11,300	6.7%
SORG/MILLET	NA	24,989	17.9%	16,060	10.0%	24,958	16.1%	22,835	13.6%
TEF	NA	32,540	23.3%	58,190	36.2%	49,189	31.8%	63,475	37.8%
COWPEA	NA	3,485	2.5%	0	0.0%	3,972	2.6%	0	0.0%
SUBTOTAL	NA	139,409	48.2%	160,803	100.0%	154,830	47.1%	168,022	100.0%
	NA	$422		$487		$469		$509	
ADMIN	NA	149,524	51.8%	0	0.0%	173,564	52.9%	0	0.0%
TOTAL	NA	288,933	100.0%	160,803	100.0%	328,394	100.0%	168,022	100.0%
		$876		$487		$995		$509	

Table 6. Agronomy Researchers

1988-89 FY 330
AGRONOMISTS

PROGRAM	RESEARCH	BUDGET 88-89 "A" 1988-89 WORKPLAN BUDGET	EXPENDITURES 88-89 "D" IITA CONTRACT SPENDING	"E" SPECIAL FUND EXPENDIT	"F" OTHER FUNDS USED	"G" ("C+D+E") COST SUBTOTAL	"I" ("A-G") COST VARIANCE	"J" ("I/G)" VARIANCE PERCENT
MRU	Lowland Agronomist	15,200	0	0	0	0	15,200	NA
MRU	Highland Agronomist	8,100	5,723	3,478	0	13,201	(5,101)	-38.6%
RRU	Rice Agronomist	9,700	7,245	4,950	0	12,195	(2,495)	-20.5%
RRU	Rice Agronomist	0	0	0	0	0	0	NA
CAR	Cereals Agronomist	6,900	11,581	2,777	0	14,358	(7,458)	-51.9%
CAR	Cereals Agronomist	0	0	0	0	0	0	NA
SMR	Sorghum & Millet Breeder	10,510	10,679	6,197	0	16,875	(6,365)	-37.7%
SMR	Sorgh & Millet Agronomist	5,550	4,339	3,744	0	8,083	(2,533)	-31.3%
		56,960	43,567	21,145	0	64,712	(8,752)	-13.5%
		$170	$132	$64	$0	$196	($27)	($0)

Table 7

1988-89 FX 330
BREEDERS

PROGRAM	RESEARCH	BUDGET 88-89 "A" 1988-89 WORKPLAN BUDGET	EXPENDITURES 88-89 "D" IITA CONTRACT SPENDING	"E" SPECIAL FUND EXPENDIT	"F" OTHER FUNDS USED	"G" ("C+D+E") COST SUBTOTAL	"I" ("A-G") COST VARIANCE	"J" ("I/G)" VARIANCE PERCENT
XBU	Lowland Breeder	7,400	0	5,715	0	5,715	1,685	29.5%
XBJ	Highland Breeder	24,000	13,676	9,681	0	23,357	1,643	7.3%
BBU	Rice Breeder	15,253	3,615	4,942	0	8,557	6,696	78.2%
BBL	Rice Breeder	0	0	0	0	0	0	NA
BMF	Sorghum & Millet Breeder	10,510	10,679	6,197	0	16,875	(6,365)	-37.7%
		57,163	26,970	26,535	0	53,505	3,658	6.8%
		$173	$82	$80	$0	$162	$11	$0

Table 5.
1988-89
ECONOMISTS

FX 330

PROGRAM	RESEARCH	BUDGET 88-89 "A" 1988-89 WORKPLAN BUDGET	EXPENDITURES 88-89 "D" IITA CONTRACT SPENDING	"E" SPECIAL FUND EXPENDIT	"F" OTHER FUNDS USED	"G" ("C+D+E") COST SUBTOTAL	"I" ("A-G") COST VARIANCE	"J" ("I/G)" VARIANCE PERCENT
TLU	Nyoibisson: exten economi	0	3,100	0	0	3,100	(3,100)	NA
TLU	Socio-economist	0	0	0	0	0	0	NA
TLU	Agro-economist	0	0	0	0	0	0	NA
TLU	Agro-economist	0	0	0	0	0	0	NA
TLU	Agro-economist	0	0	0	0	0	0	NA
TLU	Exten:socio-economist	6,600	9,993	1,739	0	11,732	(5,132)	-43.7%
TLU	Agro-economist	0	0	0	0	0	0	NA
TLU	Socio-economist	0	0	0	0	0	0	NA
TLU	Maroua: extn economist	0	0	0	0	0	0	NA
TLU	Agri-economist	0	0	0	0	0	0	NA
		6,600	13,093	1,739	0	14,833	(8,233)	-55.5%
		$20	$40	$5	$0	$45	($25)	

Table 9 FX 330

COMPARISON OF 1988-89 EXPENDITURES
WITH same year 1988-89 BUDGETS
FOR SORGHUM/MILLET PROGRAMS

	BUDGET 88-89	EXPENDITURES 88-89					
	"A"	"D"	"E"	"F"	"G"	"I"	"J"
SORGH/MILLET RESEARCHER	1988-89 WORKPLAN BUDGET	IITA CONTRACT SPENDING	SPECIAL FUND EXPENDIT	OTHER FUNDS USED	("D+E+F") COST SUBTOTAL	("A-G") COST VARIANCE	("I/G)" VARIANCE PERCENT
Breeder	10,510	10,679	6,197	0	16,875	(6,365)	-37.7%
Agronomist	5,550	4,339	3,744	0	8,083	(2,533)	-31.3%
	16,060	15,018	9,940	0	24,958	(8,898)	-35.7%
	$49	$46	$30	$0	$76	($27)	

(000's) FX 330

Table 10

COMPARISON OF 1988-89 EXPENDITURES
WITH NEXT YEAR 1989-90 BUDGETS
FOR ALL T L U's

	BUDGET 89-90	EXPENDITURES 88-89					
	"A"	"D"	"E"	"F"	"G"	"I"	"J"
	1989-90	IITA	SPECIAL	OTHER	("D+E+F")	("A-G")	("I/G)"
TLU	WORKPLAN	CONTRACT	FUND	FUNDS	COST	COST	VARIANCE
LOCATION	BUDGET	SPENDING	EXPENDIT	USED	SUBTOTAL	VARIANCE	PERCENT
Nkoloisson	13,000	7,039	1,542	0	8,581	4,419	51.5%
Mfou	26,700	4,115	3,745	0	7,860	18,840	239.7%
Ekona	17,575	17,559	4,182	0	21,741	(4,166)	-19.2%
Bambui	6,200	6,765	4,242	0	11,007	(4,807)	-43.7%
	63,475	35,478	13,711	0	49,189	14,286	29.0%
	$192	$108	$42	$0	$149	$43	

FX 330

Table 11

COMPARISON OF 1988-89 EXPENDITURES WITH same year 1988-89 BUDGETS FOR ALL T L U's

TLU LOCATION	BUDGET 88-89 "A" 1988-89 WORKPLAN BUDGET	EXPENDITURES 88-89 "D" IITA CONTRACT SPENDING	"E" SPECIAL FUND EXFENDIT	"F" OTHER FUNDS USED	"G" ("D+E+F") COST SUBTOTAL	"I" ("A-G") COST VARIANCE	"J" ("I/G)" VARIANCE PERCENT
Nkolb	6,300	7,039	1,542	0	8,581	(2,281)	-26.6%
Maroua	21,690	4,115	3,745	0	7,860	13,830	176.0%
Ekona	19,400	17,559	4,182	0	21,741	(2,341)	-10.8%
Bambui	10,800	6,765	4,242	0	11,007	(207)	-1.9%
	58,190	35,478	13,711	0	49,189	9,001	18.3%
	$176	$108	$42	$0	$149	$27	

Table 12

FY 330
COMPARISON OF 1987-88 EXPENDITURES
WITH NEXT YEAR 1988-89 BUDGETS
FOR ALL T L U's

	BUDGET 88-89	EXPENDITURES 87-88					
	"A"	"D"	"E"	"F"	"G"	"I"	"J"
TLU LOCATION	1988-89 WORKPLAN BUDGET	IITA CONTRACT SPENDING	SPECIAL FUND EXPENDIT	OTHER FUNDS USED	("D+E+F") COST SUBTOTAL	("A-G") COST VARIANCE	("I/G)" VARIANCE PERCENT
Ngaoundere	6,300	2,596	693	0	3,290	3,010	91.5%
Maroua	21,690	0	3,469	0	3,469	18,221	525.3%
Ekona	19,400	10,681	2,055	0	12,736	6,664	52.3%
Bambui	10,800	8,865	4,180	0	13,045	(2,245)	-17.2%
	58,190	22,142	10,398	0	32,540	25,650	78.8%
	$176	$67	$32	$0	$99	$78	

Table 13

		330						
		BUDGET 88-89		EXPENDITURES 88-89				
MAIZE RESEARCH		+++++++++		**********				
MORRISON		"A"	"D"	"E"	"F"	"G"	"I"	"J"
		1988-89 WORKPLAN	IITA CONTRACT	SPECIAL FUND	OTHER FUNDS	("C+D+E") COST	("A-G") COST	("I/G)" VARIANCE
PROGRAM	RESEARCH	BUDGET	SPENDING	EXPENDIT	USED	SUBTOTAL	VARIANCE	PERCENT
MRU	Lowland Breeder	7400	0	5714.673	0	5714.673	1685.327	29.5%
MRU	Lowland Breeder, xost	0	0	0	0	0	7400	NA
MRU	Maize breeder	0	0	0	0	0	0	NA
MRU	Maize breeder	0	0	0	0	0	0	NA
MRU	Lowland Agronomist	15200	0	0	0	0	15200	NA
MRU	Maize agronomist	0	0	0	0	0	0	NA
MRU	Entomologist	0	0	327.737	0	327.737	-327.737	NA
		22600	0	6042.41	0	6042.41	23957.59	396.5%
		$68	$0	$18	$0	$18	$73	

Table 14

FX 330

MAIZE RESEARCH BAMENDI		BUDGET 88-89 ++++++++++ "A" 1988-89 WORKPLAN	EXPENDITURES 88-89 ********** "D" IITA CONTRACT	"E" SPECIAL FUND	"F" OTHER	"G" ("C+D+E")	"I" ("A-G")	"J" ("I/G)"
PROGRAM	RESEARCH	BUDGET	SPENDING	EXPENDIT	FUNDS USED	COST SUBTOTAL	COST VARIANCE	VARIANCE PERCENT
MRU	Highland Breeder	24,000	12,676	9,681	0	22,357	1,643	7.3%
MRU	Maize breeder	0	0	0	0	0	0	NA
MRU	Maize breeder	0	0	0	0	0	0	NA
MRU	Highland Agronomist	8,100	9,723	3,478	0	13,201	(5,101)	-38.6%
MRU	Maize agronomist	0	0	0	0	0	0	NA
MRU	Cereals patnologist	0	0	0	0	0	0	NA
		32,100	22,399	13,159	0	35,558	(3,458)	-9.7%
		$97	$68	$40	$0	$108		

FX 330

Table 15

CEREALS AGRONOMY AND MAIZE EAROLA		BUDGET 88-89 "A" 1988-89 WORKPLAN	"D" IITA CONTRACT	EXPENDITURES 88-89 "E" SPECIAL FUND	"F" OTHER	"G" ("C+D+E")	"I" ("A-G")	"J" ("I/G)"
PROGRAM	RESEARCH	BUDGET	SPENDING	EXPENDIT	FUNDS USED	COST SUBTOTAL	COST VARIANCE	VARIANCE PERCENT
CAR	Cereals Agronomist	6,900	11,581	2,777	0	14,358	(7,458)	-51.9%
CAR	Cereals Agronomist	0	0	0	0	0	0	NA
CAR	Maize breeder	0	0	0	0	0	0	NA
		6,900	11,581	2,777	0	14,358	(7,458)	-51.9%
		$21	$35	$8	$0	$44	($23)	

Table 16

TLU BUDGETTING FOR 1989 WORK PLAN EKONA

(thousands of francs CFA)

Operation	Labor[a]	Fuel[b]	Vehicle Maintain	Field Supplies	Office Suppl.	Missions		Soil Anal[c]	Other	Contingency (5%)	TOTAL	Time SA	MB	TW	CP	CA	MM	Steam
A.1. Cassava OFT's	750	245	69	135	100	60% below+Mfe 4x(15+6)	= 1409	86	/ 70	136	3.000	1	1	32	25	30	30	9
A.2. Maize OFT's	600	205	58	90	80	(Mfe 3x4 + KC 3x2)x(3x15+2x10+5x6+27.5) 40% above+ KC[a] 4x(above)+ Mfe4x(15+6)	= 1454	129	field monitor \ 50	134	2,800	1	1	40	25	35	35	10
A.3. Farmers' tests	0	15	5	20	20	Mfe 1x(3x15+2x10+5x6+27.5)+\ KC 2x(27.5+3x15+6)	= 279.5	0	0	15.5	355	4	1	5	10	10	10	3
A.4. Post-harvest	24	80	0	20	5	Asanga 2x4x(15+6)	= 168	0	40 /cooking	13	350	1	1	3	0	5	3	1
B.1. Land prep ass.	0	60	17	0	15	(Mfe 4+ ET 2)x(27.5+2x15+6)	= 490	193.5	0	34.5	810	10	0	8	1	10	8	3
B.2. Weeding study	562.5	70	20	15	40	ET 3x(27.5+15+6)+2x27.5	= 200.5	0	20 /taxis	47	975	20	12	4	4	4	4	2
B.3. Cult.orac. ass.	0	100	28	0	20	(Mfe 5+ ET 2)x(2x27.5+3x15+6)	= 742	0	0	45	935	14	0	14	12	12	12	5
C.1. Vlg.disc/fldday	0	80	22	0	10	Mfe 4x(2x27.5+4x15+6)	= 484	0	25 /entertain	29	650	10	10	10	9	9	9	4
C.2. Impact survey	0	100	28	0	60	(Mfe 4+ ET 2)x(2x27.5+4x15+2x10+2x6)	= 862	0	0	55	1,125	14	14	0	10	14	10	5

[a] Labor at 1.500fr per man-day for field laborers and market monitors, 25.000/month for weeding monitors.
[b] Fuel (000's) at 30/car-trip Nanfe (+5 if extensive internal), 10/car-trip Kumba Corridor, 5/car-week local research, 520/year to move the three NCRE cars b/ Ekona and NCRE houses, 100/year administration (1/month each Douala and Limbe, 1/week Buea or Muyuka); vehicle maintenance on basis of 1988 costs (28% of fuel costs).
[c] Soil analysis: 4.300fr for N-P-K-Ca-Mg-pH only; 11.000fr for full chemical & physical analyses.

ANNEX G

INSTITUTIONAL ANALYSIS

ANNEX G

INSTITUTIONAL ANALYSIS

INTRODUCTION

The statement of work (SOW) for the institutional analysis requested a review (analysis) of certain aspects of the management of IRA and NCRE, the likely impact of the IRA Action Plan and the IITA Medium-Term Plan on NCRE, the nature of the institutional linkages that NCRE and IRA maintains with outside organizations, and the success of the project in construction, training, and commodities purchasing. Each of these topics is reviewed in the following paragraphs.

Objective of Phase II

The Institutional Analysis section of the report concentrates on three of the five objectives of Phase II of the project: namely:

- Development of a Cameroonian-staffed institutional capacity for research on maize, rice, sorghum, and millet;
- Establishment and maintenance of links with international, African, and Cameroonian institutions conducting agronomic and socio-economic research; and
- Provision of adequate physical facilities and equipment for carrying out the cereals research program.

These objectives are primarily concerned with institutional development.

Resources Available for Institution Building in Phase II

An important objective of the NCRE project is to help develop a sustainable Cameroonian-staffed capacity to undertake research and extension activities in maize, rice sorghum and millet. Three preconditions are required for this objective to be met. These are: (a) the development of a cadre of Cameroonians who have both the academic and practical experience necessary to undertake research and extension activities; (b) the physical resources necessary to undertake these activities such as land, buildings, and equipment; and, (c) sufficient funds.

The principal method of meeting the first two of these objectives is through training and the provision of buildings and equipment. The Project Paper (PP) states that:

Phase II will fund 15 long-term trainees to the M.S. or Ph.D. level. Grant funds of $2,633,000 are available for training.

Phase II will fund the construction of houses, offices, seed laboratories, and warehouses, and will fund the purchase of equipment, such as vehicles, furniture, and tractors. $3,605,000 of loan funds are available for construction and $2,556,000 of grant funds are available for commodity purchases.

REVIEW OF SELECTED MANAGEMENT SYSTEMS IN IRA

Institutional Setting and Organization of IRA

The Institute of Agronomic Research (IRA) is the focal point of the NCRE project. IRA is one of five research institutes in the Ministry of Higher Education, Computer Services and Scientific Research (MESIRES).

The function of IRA is to develop and carry out research programs relating to all branches of crop improvement, agronomy and forestry, and to ensure that research results are disseminated. From an administrative point of view, IRA consists of 6 research centers, 16 stations and 29 antennas. For research purposes, IRA is divided into 22 research programs. The current formal research structure for IRA is shown in Table 1.

TABLE 1

IRA RESEARCH PROGRAMS

- Food Crops
  - Cereals
  - Tubers
  - Legumes
  - Food crops
  - Plantain
  - Fruits
- Industrial Crops
  - Cocoa
  - Coffee
  - Oil palm
  - Fiber plants
  - Rubber plants
  - Banana
  - Pineapple
- Food Technology
- Soils
- Forests
  - Dense forests
  - Savanna forests
  - Wood
- Botanical
- Medical Plants
- Production Systems
- Genetic Resources

The IRA Action Plan calls for a reduction in the number of centers, stations, and antenna. The revised research structure will have 16 research programs, of which the two largest are Cereals and Farming Systems. Throughout the rest of this annex, it will be assumed that the revised administrative and research structure is operative. Table 2 shows IRA 1988-89 research budget allocations by program. It should be noted that the table refers to program budget levels, not disbursements. Furthermore, it should be noted that these figures do **not** include funds provided by USAID and other donors.

TABLE 2

RESEARCH BUDGET ALLOCATION BY PROGRAM (* 1000 CFA)

Program Group	Program	Program Budget
Cereals and Legumes	Cereals	33,000
	Legumes	10,000
Tubers, Plantains, Fruits, Vegetables	Bananas & Plantains	8,000
	Fruits	16,000
	Roots and Tubers	28,000
	Vegetables	4,000
Export Crops	Latex Plants	14,000
	Oil Plants	8,000
	Stimulant Plants	11,000
	Textiles	10,000
Farming Systems & Food Technologies	Farming Systems	10,000
	Food Technologies	9,000
Resources Management	Soils	42,000
	Forestry	22,000
	Botanic Research	18,000
	Genetic Resources	7,000

Due to external funding, the total budgets for cereals, roots and tubers, stimulant plants, and farming systems were substantially higher than the IRA budgets shown above.

IRA has four regional-based agronomic research centers which are located at Maroua, Njombe, Ekona, and Nkolbisson. In addition, there is a soils center and a forestry center based at Nkolbisson. Each center has from one to four stations, each of which operates as a substantially independent unit. There are also 35 antennas that fall under the administrative authority of particular stations.

There are four service groups based at the headquarters at Nkolbisson. These are administrative and financial services, accounting, documentation, and research.

There are parallel services at each of the centers and stations. Superimposed on this pyramidal service structure are the 16 research programs. Individual research programs cut across many centers and stations.

The economic crisis has resulted in considerable variability in the amount of research that is conducted in each of the programs. Each program can be classified as belonging to one of three groups of activities. First, there are those programs which are well supported financially by donors, primarily USAID. This group has a full range of research activities. Examples of this group include cereals, roots and tubers, and farming systems. Secondly, there are those programs that are able to get some money from parastatals and technical assistance from the Centre de Coopération Internationale en Recherche Agronomique pour le Développement (CIRAD). This group is able to conduct a limited amount of research, but does not have a full range of research activities such as found in the first group. This group contains the principal export commodities such as coffee, cocoa, and oil palm. Third, there are those programs that are starved for research funds and which are undertaking almost no research at all. Examples of this group include botanic research, food technologies, and genetic resources.

The lack of current availability of funds for those research programs that do not have external funding raises questions concerning the sustainability of the cereals and farming systems programs when USAID funding is no longer available. It also raises questions about the amount and type of research that will be carried out between now and the end of the project and how the NCRE project will be reintegrated into the IRA management system.

Analysis of IRA Personnel and Administrative Systems

The International Service for National Agricultural Research (ISNAR) has assisted IRA in the management of the institute since the early 1980s through technical assistance and short-term management training. At the request of MESIRES, ISNAR conducted a management study of IRA in 1987. This was a comprehensive study and it is not possible to do full justice to it in a few paragraphs. However, the gist of its recommendations are as follows. ISNAR recommended that:

- The Council for Higher Education and Scientific Research meet more frequently to provide MESIRES and IRA overall guidance on policy research;
- Suitable organizational structures be put in place to optimize scientific competence of the researchers, coherence and comprehensiveness of the research programs, and relevance to client needs;
- A long-term national agricultural research plan be prepared which takes account of all relevant research capability in the country to make most effective use of both Cameroonian resources and external cooperation and assistance;
- The serious imbalances in the composition of research personnel, with surpluses in middle-level administrative personnel and field labor in several stations, and shortages of technicians be addressed;

IRA's management are tied in the short run. With direction from above, and with changes in the employment rules of the public sector, there is no reason to think that IRA's management will not take the appropriate decisions at the appropriate time.

IRA needs an up-to-date data base for proper staff development. The team was informed that IRA has started a computerized personnel information system. Furthermore, the team was told that work is underway on developing job descriptions.

There is a need to upgrade skills in almost all levels of IRA, although examples of good personnel management under most trying conditions were described to the team. Some program chiefs had developed quite sophisticated techniques to ensure that scarce labor and vehicles were allocated to the most important tasks. The Action Plan calls for developing IRA-wide training plans.

In general, morale appears to be rather low in IRA, although notable exceptions were pointed out to the evaluation team. The team was told by some program chiefs that many Cameroonian researchers are still highly motivated. The current economic crisis goes a long way to explaining why morale is not universally high in IRA. Lack of funds result in difficulties in conducting research and publishing, and IRA staff are worried about job security.

One area of concern pointed out to the team was that the system of incentives for promotion was based on research publications. This raised two issues. First, people who had reached the administrative level had less time to undertake research and prepare publications. Second, there was a large backlog of publications for review. On the first issue, it seems to the team that due account should be taken of the fact that a heavy administrative load will automatically cut back the time available for publications. Regarding the backlog of publications, IRA recognizes the problem and is trying to review all drafts that have been submitted.

Finally, it was reported that discipline was still a problem although, interestingly enough, the fear of staff cutbacks has reportedly resulted in some decline in absenteeism.

Administrative and Operational Support

It would appear that standard operational guidance needs to be developed and issued by IRA in document form for all tasks and responsibilities, including reporting requirements for both management and personnel. Compliance and accuracy, especially in the case of financial procedures, should be ensured by the introduction of an independent review mechanism at the station level.

Despite certain shortcomings in operational procedures, IRA continues to operate in these difficult times. Whilst there were salaries arrears last year, it now appears that salaries are paid on time. Needless to say, the financial crisis has severely curtailed the availability of operating funds for research, transportation, and the purchase and maintenance of equipment.

Analysis of IRA Action Plan

The management of IRA recognizes that there are certain shortcomings in IRA and has taken steps to improve the situation. Two such steps are the employment of a full-time, World Bank-funded ISNAR management specialist and the preparation of an **Action Plan for Restructuring and Reprogramming the Institute of Agronomic Research.**

The ISNAR management specialist is working on a number of fundamental issues within IRA such as improving personnel and financial systems, and upgrading long-term training. The objective is to develop a consistent organization-wide system for all centers and stations, and for all research programs. Once this system is set up, IRA intends to have all research programs, including those of the principal donors, conform to the revised system. At present, the NCRE management system is set up to meet the reporting requirements of IITA and USAID rather than the needs of IRA.

In April, 1989, the Director of IRA appointed a six-person committee to prepare an Action Plan for restructuring and reprogramming IRA. The committee included the Director himself and three members of the NCRE project. The goal of the Plan is to increase the emphasis on national development oriented problem solving research, and to improve linkages with other governmental, parastatal and industrial organizations. Some of the more important points in the Action Plan are summarized in the following paragraphs. As pointed out earlier, the Action Plan is a move in the right direction. However, there is a disconcerting thread throughout the document: a statement of resource reduction is made followed by specific action plans that would increase resource requirements, rather than reducing them.

IRA will adopt a broader strategic orientation with a view toward maximizing the contribution of agricultural research to national development. The revised strategic orientation is encapsulated in four key objectives.

- To develop improved technologies for producers and support services;
- To reinforce the capacity of the Ministry of Agriculture and relevant parastatal development organizations to extend research results;
- To increase support for planning and policy making by various governmental, parastatal, and industrial organizations; and
- To improve IRA's scientific and technical capabilities through a combination of short- and long-term training, and initiation of improved procedures for programming and evaluating results.

All of these objectives are laudable.

The cornerstone of the Action Plan is an organizational restructuring. The primary structural changes will include:

- Regrouping IRA stations to form four centers based on agro-ecological zones;

- Immediately reducing the number of antennas from 35 to 17 (however, in the North, center chiefs appear to pushing to add antenna rather than reducing them);

- Collecting IRA's research programs into five program groups;

- Creating an IRA research management committee composed of six senior scientists based in Nkolbisson; and

- Strengthening and reorganizing the Directorate.

Again the team was unable to fault these proposed changes.

In future research allocation and technical management decisions, the director will be assisted by the newly constituted research management committee. A control unit will be established in the Administration and Finance Service division to increase capacity for monitoring the disposition of IRA resources. In order to shift from reactive management, budgeting and planning, acquisition, replacement and maintenance plans will be prepared for critical commodities such as buildings, farm equipment, publication equipment, vehicles, and computers. Technical management will be increased in two critical areas: research station management and computer science.

The main goals of IRA human resource development plans are to reduce personnel costs and improve the effectiveness of retained personnel. IRA will take steps to:

- Adjust the composition of research personnel in accordance with the redefined strategic objectives;

- Reduce the ratio of non-research personnel to researchers; and

- Relocate personnel to where they are most needed.

The way in which IRA intends to change the balance of personnel within the organization was shown in Table 4. As mentioned earlier, the team supports these goals but recognizes that the director's hands are tied in the short-run.

Several elements in the Action Plan reflect activities in the NCRE project. In fact, it is safe to say that almost nothing in the Action Plan should have a negative impact on the NCRE project. For example, farming systems and cereals are identified as being top-priority programs. Building on TLU experiences, one of IRA's strategic priorities will be to reinforce the capacity of the Ministry of Agriculture (MINAGRI) and parastatal development organizations to extend research results. Technology development research, the first strategic priority, will be broadened to better reflect a systems perspective. Some innovations by the NCRE project, such as program planning meetings will be institutionalized. The Plan also calls for an immediate increase in the number of TLUs and sets an eventual target of one per province.

Conclusions

1. Not all 16 research programs in IRA are fully operational. Those funded by the principal donors, such as USAID, have full research programs. Others are limping along with funds provided by parastatals and Cameroonian development organizations. A third group is receiving no funds and programs in this category are not actively engaged in research.

2. It is generally recognized by IRA and the various donors that IRA requires some internal policy guidance, organizational restructuring, redressing of personnel imbalances and better administrative systems.

3. IRA has taken action to ameliorate the situation by accepting a full-time ISNAR management specialist and developing an Action Plan which addresses the issues raised by ISNAR and others.

4. The IRA Action Plan is bold and ambitious. It will meet with only limited success without substantial political and financial support from the GRC. Furthermore, to meet only partial success, it will also likely require additional technical assistance and funding from the donor community.

5. There appears to be nothing in the Action Plan which will bear negatively on the NCRE project.

ASSESSMENT OF NCRE'S MANAGEMENT SYSTEMS AND PERFORMANCE

Research Planning

The annual IRA research planning cycle starts at the station level in November. Each researcher in each program develops a proposed research program for the coming year in the form of an operational sheet. Each individual research program is sent to the chief of program for review. The 16 chiefs of program then forward their annual work plans and budgets to the chief of research who develops a consolidated overall annual work plan and budget for IRA. The chief of research and the director together defend the work plan and budget at the ministerial level.

NCRE follows the identical steps as IRA in developing its annual work plan in the first instance. However, after the initial individual work plans are prepared a regional conference is held in January or February to review the proposals. This is a major meeting attended by all of the expatriate technical assistants, their Cameroonian counterparts, Center and Station heads, chiefs of programs, representatives of Cameroonian parastatals and development organizations, officials from government ministries, representatives of other donors, and representatives of the participating international research organizations. All in all, some 60 to 80 people attend these meetings. National conferences are held every two years.

Each of the expatriate technical assistants presents the results of his or her program for the previous year and presents the proposed work plan for the following year. Individual programs are discussed and, if required, modified. The work plans are then reviewed by the Chief of Party who may have to make adjustments in order that the overall NCRE work plan conforms to budget constraints.

The individual work plans are then consolidated into the NCRE annual work plan which is presented to USAID, IRA, and IITA. The 1988 and 1989 Annual Work Plans were reviewed by the evaluation team and were considered to be professional documents.

In principle, the process for developing works plans is a good one. However, the team was concerned that there were shortcomings in practice because some of the research programs that were finally approved by the process had deficiencies from a scientific point of view. The team thinks that a more rigorous review of individual work plans is required. For example, the team was told that, although research programs were reviewed, formal notes of the proceedings were not made and there was no requirement that changes be incorporated.

Program Implementation, Reporting and Monitoring

Individual technical assistants are responsible for undertaking their approved work plans and preparing their research results. Formal reporting on activities is done semi-annually by each of the technical assistants. These semi-annual reports are consolidated by the chief of party and presented to USAID, IRA, and IITA. The 1988 Semi-Annual Progress Report and Annual Report were reviewed by the evaluation team and found to be professional.

In addition to reviewing the semi-annual and annual reports, the chief of party tries to visit all of the technical assistants once or twice per year. The chief of party prepares an annual performance appraisal on each of the technical assistants based on field visits and a review of research results.

In addition to the functions outlined above, the chief of party is also responsible for liaising with USAID, IRA, and IITA, assisting IITA in recruiting candidates for technical assistance positions, assisting IRA to develop overall plans for linking research to extension services and farmers, planning and coordinating long-term and short-term training of national counterparts and providing overall technical leadership to the technical assistants. The Chief of Party has performed most of these functions well. However, as will be shown later, the team has reservations at the lack of a formal training plan and problems with short-term consultancies still appear to exist. It should be noted, however, that long-term training is the responsibility of USAID. Relations between NCRE and IRA seem to be very harmonious.

Inevitably in a team of professionals as large as the NCRE team there will be divergent views. The evaluation team determined that when differences of opinion arose, they were discussed openly and frankly.

Conclusions

1. The systems and procedures put in place to manage NCRE's core research responsibilities seem to be well designed. The team has some concerns that while the systems themselves may be adequate, the research review process may not be sufficiently rigorous to ensure that all research projects are of the best possible scientific design.

In light of this the team recommends the following to improve the process.

First, the research program be reviewed by a sub-set of the large group at the annual meeting.

Second, the comments and suggestions made in the review process be recorded.

Third, the comments should be formally reviewed and incorporated into the design of the research. If they are not incorporated there should be an explanation of why they were not incorporated.

Fourth, the normal review of the implementation stage of the research should verify that the accepted suggestions were acted upon.

IMPACT OF IITA MEDIUM-TERM PLAN ON THE NCRE PROJECT

IITA launched a strategic planning study in 1986. This resulted in a volume entitled: **IITA Strategic Plan 1989-2000**. This was followed by the publication of a shorter document entitled: **IITA Medium-Term Plan 1989-1993**. This section summarizes the medium-term plan and analyzes it in terms of its possible impact on the operations of the NCRE project.

IITA has adopted four program strategies to ensure greater focus in the use of its limited resources. These are:

- IITA will place primary emphasis on improving the farming systems of the **lowland humid and subhumid tropics of West and Central Africa**;
- IITA will focus on the **African smallholder or family farmer**;
- IITA will establish **small research substations in the key ecological zones of West and Central Africa**. These are the **humid forest, the forest/savanna transition, the moist savanna, and the inland valley ecosystem** which is to be found in all three of these zones; and
- IITA will undertake a **farming systems** orientation in all of its future work.

IITA's primary objective is to develop sustainable food production systems that are appropriate for the smallholder family farms of West and Central Africa. The Medium-Term Plan outlines three major initiatives: resource management research, commodity improvement, and crop management research. One of these, commodity improvement research, is relevant to this analysis.

Commodity Improvement Research

A basic premise of the IITA strategic planning exercise was that the scope of commodity research should be reduced in order to bring available resources more effectively to bear on the critical problems. The IITA Board of Trustees established the following strategies for commodity improvement research.

- IITA should have only three major commodity improvement programs -- cassava, maize, and cowpeas.

- IITA has terminated research on cocoyams and has transferred its global mandate for sweet potato improvement to CIP.

- Rice improvement research will be phased out because of the recent revitalization of WARDA. However, IITA will maximize the impact of its rice improvement program by focusing its limited resources on a single ecosystem, the inland valleys. An important reason for focus on the inland valleys was to compliment WARDA's research, which previously had not involved this ecosystem. Furthermore, IITA will discuss with IRRI and WARDA the rice research needs of Africa which lie outside the WARDA geographic mandate.

Apparent Implication for the NCRE Project

The implications of the IITA Medium-Term Plan for the NCRE project would have been serious. Cutting back staff to 2-3 researchers in Cameroon would have decimated the NCRE project, as would have the phasing out of rice research in favor of WARDA, concentrating maize research on the lowland ecology, and terminating all research on sorghum and millet in favor of ICRISAT.

The seriousness of the situation was seized upon by USAID/Cameroon. The files reveal that appeals were made to IITA to reconsider their position as far as the IITA/NCRE project in Cameroon was concerned. Even so, USAID undertook a considerable amount of contingency planning in the second half of 1988; including an analysis of the possibility of a total pull-out by IITA necessitating a totally new contractual arrangement with universities and consulting firms and a substantial reduction in the scope of the NCRE project. The seriousness of the situation was further brought home by the fact that as late as April 1989, the IITA/NCRE chief of party thought it necessary to circulate a proposed timetable for the phasing out over the next few years of NCRE technical assistance.

Cameroon Exception

The correspondence and personal contact between USAID and IITA clearly had an impact on IITA thinking. It now appears that IITA is willing to make the IITA/NCRE project a total exception to its Medium-Term Plan. The full complement of 19 technical assistants could remain on board, although rice research would be subcontracted to WARDA and sorghum and millet would be subcontracted to ICRISAT. The director general of IITA has indicated orally that IITA would be willing to be the "prime contractor" for all parts of Phase III, including purchasing and training.

Conclusions

(1) Provided that IITA is willing to make a written commitment to the effect that the Medium-Term Plan will not be applied to Cameroon, USAID still has the full range of contractual possibilities open to it for Phase III, including: (a) having a single contract with IITA for all aspects of the project which in turn could subcontract selected components of the project to WARDA, ICRISAT, or other agencies; (b) having direct contracts with IITA, ICRISAT, WARDA and other agencies; and, (c) having a single contract with a university consortium or consulting agency which may or may not subcontract selected components of the project.

(2) In deciding which of the several options open to it, USAID will, of course, take into consideration the regional strengths of IITA, IITA's experience in Cameroon and the strong personal linkages that have developed between the IITA staff in Ibadan and the IRA staff in Nkolbisson.

INSTITUTIONAL LINKAGES

While IRA is the primary focus of the NCRE project, collaboration and institutional linkages are maintained with other ministries, parastatal development organizations, and research institutions. The nature of these linkages will be described in the following paragraphs.

National

MINAGRI has overall responsibility for most activities affecting agricultural development, including statistics generation, extension, and management of several provincial based development projects. The main connection between MINAGRI and the NCRE project has been training of extension agents and collaboration on mini-kit demonstrations and tests.

The current economic crisis has resulted in a significant cut back in the operating funds available to MINAGRI and the ability of MINAGRI to provide the full range of extension services. This situation is a major constraint on the effectiveness of the extension portion of the NCRE project. The World Bank plans to provide funds to revitalize the MINAGRI extension service through its T and V project, scheduled to begin in 1990. This should improve the situation to the extent that the

TLUs would then have a functioning extension service with which to liaise.

Parastatal organizations play an important role in agricultural development in Cameroon and, until recently, have had more resources for extension, testing and demonstration than the MINAGRI extension service. Consequently, some parastatals have served as primary collaborators in particular areas in lieu of MINAGRI. Long-term collaboration in regional testing with SODECOTON in the North and the Extreme North is the outstanding example. Project rice researchers collaborate with SEMRY in the North, UNVDA in the North West Province, and SODERIM in West Province.

In the North West Province, MIDENO has wide-ranging activities encompassing training and demonstrations. The TLU has provided backstopping for MIDENO training, and some trials are implemented at MIDENO training and demonstration centers. In Center Province, the TLU has trained MINAGRI agents, but now is concentrating on collaboration with SODECAO. The Ekona TLU continues to work primarily with MINAGRI for extension and training activities. The effectiveness of these linkages is hard to judge definitively. However, the team is under the impression that linkages between NCRE and the parastatals and MIDENO is more effective than that between NCRE and MINAGRI.

Linkages also are being maintained with several Cameroonian research programs -- including other research programs in IRA and at Dschang University Center. NCRE project research programs regularly provide field experience opportunities for Dschang students, and students from other agricultural schools. The DG of Dschang University Center expressed strong interest in further intensifying cooperation between the University, NCRE, and IRA. The team thinks that these linkages could be improved.

Other Donors

NCRE collaborates with other donors within IRA, such as the French CIRAD, the Canadian IDRC, and the British Gatsby Foundation. NCRE also works closely with other USAID projects where appropriate.

International Research Organizations

International collaboration is maintained with several research centers, among the most important of which are IITA, ICRISAT, WARDA and CIMMYT. The NCRE project provides active support to the West African Farming Systems Research Network (WAFRSN). Again, while there is regular contact between NCRE and the various international agencies, it is very difficult to judge whether NCRE is really getting the very best possible advice. Certainly, regarding the review of annual work plans, it appears to the team that the review process by the international organizations might be more rigorous.

Conclusions

1. The NCRE project appears to be well integrated into the national and international research and extension system.

2. The NCRE annual conference to review past research and plan future research to which all of the national and international cooperating organizations are invited appears to be potentially a particularly useful mechanism provided that research plans are rigorously reviewed. Ways in which the review process could be more rigorous were outlined earlier.

INSTITUTIONAL DEVELOPMENT

The model of institutional development that is used in this annex is that a sustainable research institution is one that has sufficient trained research staff, has sufficient physical research structure such as buildings, laboratories, and equipment, and sufficient research funds to fulfill its mandate. The following paragraphs will look at topics such as long-term training, short-term training, short-term consultancies, construction, and equipment purchasing to determine the progress that has been made in providing a trained research staff and sufficient physical research infrastructure.

Long-Term Training

The PP made allowance for 15 training positions to the masters or doctorate level. Thus far, one of the 15 has already completed his training and has returned to IRA, nine are in training in the United States and the other five have been selected and will, if all goes well, leave for the United States later this year. The students are studying a broad range of subjects including, agricultural economics, maize breeding, rice agronomy, entomology, and cereals extension.

Table 5 shows the number of students who have been trained under Phase I and II, the degree that they obtained, the subject studied, the year that they returned to Cameroon, and their current placement in IRA.

TABLE 5

TRAINING UNDER THE NCRE PROJECT

Trainee	Degree	Subject	Year	Loc
Trained under Phase I				
Julius Takow	M.Sc.	Rice Agronomy	1983	Nkol
Charles The	Ph.D.	Maize Breeding	1983	Nkol
Christie Ngundam	B.Sc.	Cereals Agr & Ext	1983	Ekon
Cletus Asanga	M.Sc.	Cereals Agr & Ext	1984	Dsch
Fabien Jeutong	M.Sc.	Rice Agronomy	1984	Dsch
Edward Ngong-Nassah	M.Sc.	Cereals Agr & Ext	1984	Bamb
Benard Soneh	B.Sc.	Cereals Agr & Ext	1984	Ekon
Jean-Bosco Zangue	M.Sc.	Agronomy	1986	Nkol
Claude Nankam	M.Sc.	Plant Pathology	1986	Bamb
Kenga Richard	M.Sc.	Sorghum Breeding	1988	Maro
Meppe Francois	M.Sc.	Extension	1988	Bamb
Marc Samatana	M.Sc.	Agric. Econ.	1988	Bamb
Titus Ngoumou	M.Sc.	Cereals Agronomy	1988	Garo
Chrysanthus Njoh	Ph.D.	Entomology	1988	*
Edward Ngong-Nassah	Ph.D.	Cereals Extension	1988	Bamb
Trained under Phase II				
Jupiter Ndjeunga	M.Sc.	Agric. Econ.	1989	Nkol
In Training under Phase II				
Jacob Eta-Ndu	M.Sc.	Maize Breeding	1989	
Manfred Besong	Ph.D.	Agric. Econ	1989	
Julius Takow	Ph.D.	Rice Agronomy	1990	
Pauline Tekeng	Ph.D.	Agric. Econ	1990	
Ngoko	M.Sc.	Plant Path	1991	
Ngueguim Martin	M.Sc.	Ext. Agron.	1991	
Celicard Zongkeng	M.Sc.	Plant Breed	1991	
Ngninbeyie Pascal	M.Sc.	Plant Breed	1991	
Andre Djonnewa	M.Sc.	Plant Breed	1991	

TABLE 5 -- Continued

Trainee	Degree	Subject	Year	Loc
Selected for Training				
Mrs. Enyong	Ph.D.	Agric. Educ.		
Ndioro A Mbassa	M.Sc.	Maize Breed		
Ndikawa Ranawa	M.Sc.	Cereals Agron.		
Anotole-Japhet	M.Sc.	Cereals Agron.		
Dimithe Georges	M.Sc.	Agric. Econ.		

Dsch	Dschang
Bamb	Bambui
Ekon	Ekona
Nkol	Nkolbisson
Maro	Maroua
Garo	Garoua
*	deceased

Problems about long-term training were voiced by some of the technical assistants to the evaluation team. These included delays in processing candidates, delays in students completing their studies, and minor concerns about the relevance of either some courses or the thesis topic. Some of the technical assistants expressed concern at the very small role they played in the selection of candidates and the program of study that the students followed.

The communication chain in getting students accepted into U.S. universities is long with many potential sources for delay. It includes NCRE, IRA, several GRC ministries, USAID, USDA and US universities. Rather than be frustrated with the length it takes to get students enrolled, a more appropriate response might be amazement that this cumbersome system has enrolled 10 students and selected the remaining five.

The options open to USAID for the rest of this project are twofold. First, the system could be left as it is. The advantage of this is that the current system works, albeit slowly. The principal disadvantage is that no one has overall responsibility for training and human resource development in the NCRE project. As a result, a human resource development plan does not exist which shows who needs to be trained, when they need to be trained, in what subject and where they will return after they have been trained. Such a plan is essential if the gains made by the project are to be sustained after USAID stops providing financial support for the project.

Second, USAID could transfer the whole of the human resource development function to IITA which might sub-contract the training to a Title XII university. The advantage of this option, and perhaps the overriding advantage, is that one organization would be responsible for all human resource development and would be held accountable if the function were not performed satisfactorily.

Short-Term Training

A file review indicates that 18 participants received formal short-term training in Phase II at IITA (13), ICRISAT (1), IRRI (3), and CIMMYT (1). In addition, NCRE provided about a dozen in-service courses on such topics as agronomic field research, intensive maize production, survey interviewing, computer training, and field days.

Short-Term Consultancy

Short-term consultants remains an issue in the project. Some TAs expressed concern that they were not getting all of the backup support from IITA that they had requested. The issue was also the subject of correspondence between USAID and NCRE. The team undertook an evaluation based on material provided by NCRE. This material shows that some 19 short-term consultants were requested in the annual work plan for 1988/1989. Of these requests, five were withdrawn by the TA after discussions with the chief of party. Of the remaining 14, six short-term consultants came to Cameroon. The remaining eight requests were not satisfied for a number of reasons including last-minute cancellations by the consultant, poor terms of reference by the technical assistance, scheduling difficulties with the selected consultant and rejection of the consultant by USAID. An additional four short-term consultants, who had not been identified in the 1988/89 work plan, visited Cameroon in 1988/89 for a total of ten.

Concern was expressed by USAID by the apparent complexity of the decision making process and the authority of the COP in making decisions. The team spoke to the COP about the USAID concerns and was told that short-term consultants were requested by the technical assistance, the request was discussed with the COP, and that the COP, if he agreed with the request, forwarded the request to Ibadan. Regarding the decision making authority of the COP, the COP said that if the issue or request fell within the bounds of the USAID/IITA contract, he had authority to make a decision. However, if the issue or the request fell outside the bounds of the contract he raised the issue with Ibadan for decision.

Construction

The PP gave detailed requirements for houses, offices, warehouses and laboratories. These requirements turned out to be "indicative" and did not reflect actual needs at all. As a result, USAID initiated a detailed needs analysis in June of 1986. Since that time, needs have been established, costs have been updated, designs were initiated, PIO/Cs were drafted, A/E services were solicited, and bid documents were prepared and approved and issued for the houses. However, as yet, construction has not started on any of the houses, offices, warehouses or laboratories.

The team spent considerable time with the TAs, NCRE management and USAID determining why the process had taken so long. It appears that there are a number of contributing factors including inappropriate specifications in the PP, a wide variety of design ideas on the part of the TAs, delays caused by the occasional absence of the Director of IRA who does not have a deputy with signing authority, and complications with the GRC and USAID rules and regulations.

Again USAID has two choices. First, it can continue the management of construction itself. Second, it could transfer responsibility to IITA. While the latter choice runs the risk of being disruptive, with the danger of even greater delays in completing the construction, it would have the advantage that responsibility would rest with one contracting agency which could be held accountable if construction did not proceed at the rate agreed upon in the construction plan.

Purchasing

In the first two years of Phase II all purchasing was undertaken by USAID. Problems associated with TAs being unable to communicate their scientific requirements in a form understandable to USAID led to a decision to transfer procurement of field and scientific equipment to IITA.

Responsibility for procurement of field and scientific equipment was transferred from USAID to IITA in March 1988. This amendment added $370,000 to the project budget. It would appear that this move has speeded up purchasing somewhat. For example, NCRE states that some eleven and one-half tons of goods have been imported by IITA since it took over responsibility for purchasing. NCRE still voices some concerns with the speed of getting goods through USAID. An example that they cited was tractors that have been on order for 18 months. However, NCRE is the first to admit that even with their own system of purchasing, there are still unacceptable delays.

Phase I Evaluation Report

The Phase I evaluation report, drafted in February 1987, identified problems in procurement, construction, long-term training and short-term consultants as critical issues. The recommendations on these issues that were made two and one half years ago are considered important enough that they are reproduced below.

1. Review and revise where necessary the system for procurement for both USAID and IITA authorized commodities and make the system known to all personnel affected, USAID/IITA;

2. Expedite the completion of the three houses and construction of other buildings scheduled for the research sites, USAID/IRA;

3. Review procedures for managing the participant degree training program; and

4. Take positive action in identifying and correcting the provision of short-term consultation both in direct response to NCRE/IRA requests and to provide general support in disciplines in which IRA lacks expertise, IITA.

It is clear that, two and one-half years after the submission of this report, purchasing, construction, training, and short-term consultancies are still issues. The principal reason for this is the diffuse nature of the responsibility for performing these functions: too many organizations and too many people in each of the

organizations are involved. As a result of this lack of responsibility, no single organization has the authority to make the system work.

Conclusions

1. The diffuse nature of the responsibility for purchasing, construction, and training results in no single person or organization being responsible when inadequate progress is made. This is largely the result of poor project design.

2. To resolve this situation, it is concluded that all parts of the NCRE project should be contracted out to one single organization.

3. Insufficient progress has been made in developing a formal human resource development plan which will lead to a sustainable Cameroonian-staffed cereals and farming systems programs.

4. Plans must be developed to Cameroonianize the cereals and farming systems programs. These plans should include human resource development, training, purchasing, construction, and short-term consultancies.

5. Continued efforts should be made to ensure that the Director of IRA has a deputy with signing authority so that business requiring the director's signature is not held up during his absence.

The team recommends that:

First, all activities under the NCRE project be under one contract in Phase III.

Second, in the interim, a formal committee be set up consisting of NCRE and USAID that will resolve outstanding issues on training, purchasing, construction, and short-term consultancies.

Third, that NCRE prepare a detailed training and human resource development plan, purchasing plan, construction plan and short-term consultancy plan. In developing the training plan, it is recommended that USAID make available at least five more training slots to fill manpower gaps in certain critical disciplines. The suggested areas are: soil science (2) and agricultural economics/policy (3).

ANNEX H

TESTING AND LIAISON UNITS: ORGANIZATION, ROLE, PERFORMANCE AND IMPACT ON TECHNOLOGY TRANSFER

NCRE PROJECT, PHASE II EVALUATION
TESTING AND LIAISON UNITS

SUMMARY OF MAJOR OBSERVATIONS/RECOMMENDATIONS

- The concept of testing and liaison units (TLUs) has become accepted as an integral part of the research system. The four TLUs have made satisfactory progress (see section 5.2) and have contributed to the technology development and transfer process and have established viable links with the extension and development agencies. During the balance of Phase II and follow-on phase, TLUs should rationalize the volume and spread of activities and improve the quality of their activities. Recommendations made are directed at the improvement of certain key activities.

- The TLUs have conducted farm and village level surveys which characterized production systems and identified constraints, problems and opportunities. Although there have been close linkages and working relationships with on-station research, it was not always evident that agronomic research (both on-station and on-farm) reflected its relevance to identified production constraints. This appears to be a direct result of the nature of agronomic research in the National Cereals Research and Extension (NCRE) project which has focussed more on supporting varietal improvement work and less on issues which could be termed as "production sustaining technologies." NCRE should devote more attention to research on production sustaining improvements, tightening the link between on-station experimentation and observed constraints. It is recommended that TLUs and their on-station counterparts devote greater attention to agronomic research which responds to the identified constraints. To address the above the following staffing arrangements are recommended.

- In the follow-on phase TLUs should be staffed by an agricultural economist[1] and an IRA agronomist trained at M.S level or more. On-station agronomists (TA or IRA) should devote 50 percent of their time to working with TLUs; they should conduct research-managed and farmer-managed on-farm tests in collaboration with the TLU staff, and provide on-the job training to the less

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[1] The present incumbent at TLU/Ekona, a social anthropologist, adds a valuable skill and perspective to the TLU/Technical Assistance (TA) teams of agricultural economists and agronomists and should be continued. However short-term assistance in economic analysis could be provided from time to time either through the TLU Coordination Unit or otherwise. Similarly other TLUs may be provided short-term TA in rural sociology and anthropology as needed.

experienced counterparts (or colleagues) in the design, analysis, and evaluation of tests. The remaining 50 percent of the time of the on-station agronomist should be devoted to crop improvement programs and conducting necessary on-station research on cropping/production systems research. It is anticipated that at the beginning of the follow-on phase there will be sufficient number of cereal agronomists in IRA trained at the M.S level. However there will not be any IRA economists qualified and experienced to guide the TLU program.

- In view of the limited experimentation in the area of agronomy related to the development and testing of interventions in the area of "sustainable production systems," it is recommended that the TA commodity agronomist position at Nkolbisson be designated as a NCRE production system agronomist responsible for conceptualizing, designing and implementing a comprehensive program of research for the development of soil- and crop-management technologies. Such a program should have a medium- and long-term focus. The present incumbent experienced in soil-crop management systems should coordinate the program implementation at three locations (Nkolbisson, Ekona, and Bambui) in collaboration with the stations and TLUs as needed. Location of the production systems coordinator along with the TLU Coordination Unit at Nkolbisson should help better integrate soil and crop-management research at the station and on-farm level responding to farmer needs.

- TLUs' performance in moving improved varieties of maize, rice, sorghum, cassava, and cowpea through on-farm testing to extension stage has been good. However, they have not devoted much attention to the social and economic analysis of technologies and their impact on production, productivity and income. TLUs have become aware of the issue and are beginning to act upon it. It is recommended that TLUs devote greater attention to economic evaluation of technologies and impact studies.

- TLUs relationships with extension and development agencies have been productive. TLUs conducted significant amount of training of extension workers in new technologies, conducting rapid appraisal surveys and on-farm tests. This has been reported to be a significant contribution to the improvement of the quality of extension work. Although research-extension interactions have been frequent and many, it appears from certain reports that the quality and content of interaction needs to be improved. While we have no specific suggestions in this regard. It is recommended that the TLUs explore with counterpart extension agencies various ways of strengthening the "quality and content" of interactions.

- On-farm tests have been conducted in collaboration with extension agencies. To improve the relevance of on-farm tests and respond to the needs of extension, it is recommended that greater involvement of extension specialists (middle level or above) be sought in designing on-farm tests (identifying and choosing treatments which correspond to observed constraints) as well as initiating long-term, on-the-station research in search

of solutions for critical problems. This incidentally will also improve the quality and content of research-extension interactions.

- Coordination of TLU activities has emerged as an important concern. NCRE has taken steps to designate TLU coordinators and should bring about greater coordination in certain key areas noted in the main report.

- Two major concerns with institutionalization of TLUs are the development of national staff and cost effectiveness of TLU operations. NCRE TA should devote increased attention to staff training, giving the counterparts increasing responsibilities in planning TLU operations, analysis and reporting. Many of these responsibilities are performed by the technical assistant at present.

  TLUs should keep cost-effectiveness of their operations in view. This would mean greater attention to the relevance, quality, content and size of the activities and using cost effective methodologies. TLU/Nkolbisson activities appear to be more cost effective. At present, TLUs are reported to be absorbing about 30 percent of NCRE operating costs. It is recommended that TLU coordination unit evolve guidelines in this regard and review future work plans to ensure cost effectiveness.

- Written communications of technologies and on-farm research results in usable form by the extension agencies and other clientele have been observed to be weak. It is recommended that TLUs develop and publish information material on IRA technologies for use by the extension agencies.

- Systematic collection and reporting of feedback of on-farm testing is needed. It is recommended that TLUs provide formal feedback to extension agencies through a one-half or one day extension-research workshop held annually in the region either separately or in conjunction with a training program and that farmer evaluations and feedback be reported as a part of the analysis of on-farm test results.

- Overlapping role of TLU and development agency in adaptive research. MIDENO has an adaptive research unit funded by a multi-donor group. It has established nine technology development centers in different-ecological zones of the North West Province. It has been conducting a parallel program of on-farm testing and is expected to intensify on-farm testing and rural appraisal surveys in Phase II. This will lead to both the agencies MIDENO/PDA and IRA/TLU/Bambui conducting on-farm testing, when there are only very limited interventions and technologies screened at the station and ready for testing on the farms (except a few varieties). Therefore, there is a great potential for duplication of TLU adaptive research activities by MIDENO leading to a waste of both Cameroonian- and donor-provided resources. It is strongly recommended that IRA management take up the issue with MIDENO, after reviewing the March 1989 evaluation report which has supported MIDENO intensifying its own on-farm testing and constraint identification activities.

- The process of technology generation and transfer [flow of research through on-station screening, multilocational testing, research-managed and farmer-managed on-farm tests, regional testing (mini kits) and finally demonstrations (extension function)] appears to be somewhat haphazard. It is recommended that TLU coordination review the process followed in each TLU and develop guidelines to improve the options for testing identified themes either on-station or on-farm (researcher managed or farmer managed), and regional testing. A cost-effective solution requires that the four levels of technology, testing, adaptation, and transfer be clearly linked to the scientific rigor (also farmer risk) needed for testing and evaluation of technologies before they reach the demonstration stage.

- Research extension linkages are generally strong and good. Strength of the development/extension agency seems to be fundamental to good linkage and collaboration (financial and technical capacities). However recent financial setbacks in one collaborating agency, SODECOTON, have prompted that agency to demand reimbursement of the cost of their extension agents' time spent on conducting foodcrop tests on the farmers fields (50,000 CFA per test). SODECOTON's priority interests are in cotton development, although foodcrops such as sorghum, cowpea, and peanut are considered essential elements of the cotton-food crop rotation system. This tendency poses a fundamental question relating to extension-research collaboration criteria. We recommend that IRA take up the matter with SODECOTON and not pay the extension participation costs since it would have a major recurring cost implication for IRA.

1.0 NCRE PROJECT PHASE-II

The NCRE Project Phase II (NCRE) began in 1986 as a continuation of NCRE Phase I, which lasted from 1981-1985. The Phase I goal and purpose were reiterated in Phase II. Thus NCRE Phase II was to "continue development of Cameroon's institutional capacity to provide high-quality research on cereal crops and to facilitate transmission of research results to the farmer, toward the goal of increasing food production." To facilitate the transmission of research results to the farmer, the TLU concept was built into Phase I and was expanded in Phase II, increasing the number of TLUs from one to four. Thus in Phase II three additional units were established at Yaounde, Ekona, and Maroua. TLU/Bambui established in Phase I continued in Phase II. The TLUs were expected to provide a) description of traditional production systems, b) identification of agronomic constraints, c) assessment of opportunities and limitations of existing farming conditions, and d) on-farm testing and evaluation of technologies. The general idea was to improve the relevance of on-station research to farm-level production problems, speed up the technology development and transfer process, and bridge the gap between research and extension. Thus, operationally, TLUs were designed to be an integral part of the research system, working collaboratively with extension and development agencies and farmers to facilitate technology development and transfer process.

The TLU concept developed and promoted in the NCRE project is a major institutional innovation in a country where agricultural research and agricultural development responsibilities are divided between two ministries at the national level, the Ministry of Higher Education Computer Services and Scientific Research (MESIRES) and the Ministry of Agriculture (MINAGRI), respectively. The role of the TLUs in contributing to the development of farmer-relevant research agenda and testing, evaluation and transfer of technologies has begun to be appreciated.

2.0 ORGANIZATION OF TLUs

2.1 Location

Four TLUs are operating today serving one or two major agro-ecological zones and subzones within those agro-ecological zones. Agro-ecological zones and administrative regions mandated to be covered by each TLU is shown below. However, the TLU teams have not been able to cope with their regional mandates and have been concentrating almost exclusively in the Central, North West, South West and Extreme North Provinces.

TLU	Year	Ag. Ecological Zone	Admin. Provinces
NKOLBISSON	1986	Forest Transitional	Central South
BAMBUI	1982	Western Highlands	North West
EKONA	1986	Forest Transitional Littoral	South West
MAROUA	1986	Semiarid	Extreme North North

2.2. Staffing

Each TLU is staffed by Cameroonian researchers and two expatriate TA specialists, an agricultural economist and an extension agronomist. Exceptions are TLU-Ekona where it is staffed by a social anthropologist and extension agronomist and TLU/Bambui where the extension agronomist has not yet been assigned. The previous agricultural economist was reassigned as NCRE Project Team leader and the extension agronomist who also has training in agricultural economics has been serving somewhat in a dual role.

Cameroonian staff consists of an agricultural economist, one or more agronomists, and several technicians. There is variation from TLU to TLU in staffing. In general, staffing of the TLUs by qualified Cameroonians has been uneven, and somewhat haphazard.

The following reasons appear to account for the above:

a) There does not seem to be a detailed staffing pattern for each TLU identifying different levels and numbers of research personnel required, although everyone seems to agree that a TLU needs an agricultural economist and an agronomist.

b) Lack of sufficient number of qualified Cameroonian researchers (M.Sc. level or more) and need for higher level training. Several Cameroonian researchers who will be ultimately staffing TLUs are undergoing training or preparing to depart for training.

c) The Tendency is to reassign researchers to TLUs from IRA units which either lack operating funds or have surplus researchers. This is a consequence of structural reform and economic crisis.

On the TA side, there have been extreme delays in staffing the TLUs, resulting in uneven progress and performance of TLUs. However, it needs to be pointed out that the technical assistants have been playing a major role in implementing the TLU program and training counterparts. Late assignment of economists to the Nkolbisson and Maroua TLUs has resulted in a severe setback to economic analysis of on-farm tests.

The current status of technical assistants' assignment to the TLUs is noted below.

TLU/NKOLBISSON:

The TA team consists of an extension agronomist (7/86) and an agricultural economist (10/88). This team is also responsible for the overall coordination of TLU activities in the project, providing guidance and technical support. Coordinating role of this team is discussed in section 3.5. Two Cameroonian researchers working in this TLU are expected to depart for training in January 1989 (Dimithie for M.Sc. Training in Agricultural Economic and Mrs. Enyong for M.Sc. training in Agronomy). Dimithie will be replaced by a Cameroonian agricultural economist (Mr. Jupiter Ndjeunga) returning from M.Sc.-level training in agricultural economics (ETA 7/89). For the remaining period of project assistance, this TLU can function reasonably well with the two technical assistants, an IRA-agricultural economist and three relatively young agronomists (assigned since 3/89).

TLU/EKONA:

The TA team consists of a social anthropologist and an extension agronomist. IRA researchers assigned this TLU consist of an agricultural economist who is expected to return shortly (9/89) from Ph.D. level training in Nigeria. An IRA

agronomist returned from M.Sc.-level training in the United States and was assigned to the TLU in 1/89. A TA extension agronomist has been assisting with on-station agronomic research. By the end of the current phase, IRA agricultural economist and extension agronomist should be able to gain sufficient experience in implementing TLU activities.

TLU/BAMBUI:

The TA team consists of an agricultural economist supported by two IRA researchers, an agronomist and agricultural economist (Mrs. Pauline Zeking, M.Sc. agronomist, Mr. Samatana, economist); an ingénieur agronome; 2 technician superiors and a technician. This was the first of the TLUs to be started under Phase I.

TLU/Maroua (TLU/M):

The TLU/M staff consists of a technical assistant, extension agronomist (since 6/88), a technical assistant agricultural economist (since 2/89), an IRA/ingénieur agronome (5/89), three IRA technicians and six village-level enumerators.

2.3 Staff Development

While IRA senior researchers who staff the TLUs are being trained at M.Sc. and Ph.D levels, increasing numbers of junior-level researchers (ingénieur agronome level) and technicians are being assigned to the TLUs. While this junior cadre is essential to manage and implement diverse activities undertaken by the TLUs, their training and development is essential. To some extent this is provided on-the-job by both technical assistants and IRA researchers. In order to instill a commitment to the on-farm research it is essential to expose them to the methods and processes of on-farm research based on the farming systems approach. The TLU coordination unit should assume the responsibility to develop and implement a comprehensive course consisting of rapid rural appraisal surveys, constraint analysis, and design and implementation of an on-farm testing program. Appropriate training resources should be identified and used in training. The University Center at Deschang/University of Florida should be able to provide training in this area.

A second approach to staff development would be to encourage and require the junior-level staff (both ingénieurs and technicians) to jointly author papers and research bulletins that could be presented at regional conferences outside Cameroon. Similarly, as an incentive, greater opportunities should be provided to the junior cadres for short-term training outside Cameroon.

2.4 Institutionalization of TLUs

The TLU concept undoubtedly is well accepted within IRA. However, it is far from certain to what extent TLU operations will be funded by GRC/IRA at the end of follow-on Phase if the economic situation does not improve. The real test will emerge then. Since inception, the TLUs have been fully funded by NCRE project

except for the salaries of IRA staff assigned to the TLUs. The importance of TLUs has also been recognized by the provincial extension services as well as development agencies (for example, MIDENO) and parastatals (SODECOTON and UCAO).

Several things need to be done in order to promote the institutionalization of TLUs. Important among them appear to be:

- Development of a rational staffing pattern that the national system can afford;

- Improving the cost effectiveness of TLU operations in testing and evaluation of technologies. This will include methodologies for careful zoning, selection of a reasonable number of test sites and clustering of regional tests and conducting adequate number of trials and tests through the participation of well trained and oriented extension agents; and

- Identification, selection and motivation of researchers to work in TLUs who are interested and capable of working in off-station conditions.

It has been reported that often candidates are selected for long-term training overseas who are highly on-station research oriented and have no intention of returning to TLUs.

2.5 Recommendations

1. The IRA and NCRE team should develop a staffing pattern for each TLU specifying the position, qualifications, and number at each level (researchers, ingénieur agronomes, technicians, enumerators, and so forth).

2. Based on the staffing pattern and availability of trained personnel, additional IRA researchers should be trained to fill the identified positions.

3. The TA extension agronomist at Ekona should devote about 50 percent of his time to on-station research (OSR) while devoting the rest of the time to on-farm research (OFR), working closely with the IRA agronomist who has M.Sc.-level training in agronomy.

4. TA on-station agronomists (both the technical assistant and his counterpart) at Bambui should devote 50 percent of their time to OFR. This is likely to induce the type of on-station agronomic research most relevant to the farmers' production problems in the field. This will enable the agricultural economist to devote more time to diagnostic surveys, farmer evaluation surveys, impact studies and assessments. The extension agronomist positions should be deleted from NCRE-TA staffing pattern in the follow-on phase.

5. Anticipated coverage of the Northern Province (SODECOTON Zone) by

TLU/Maroua should be examined both for cost-effectiveness and practicality in view of the proposed extension of TLU/Maroua operations of into additional zones in the Extreme North (mandara mountains).

3.0 PERFORMANCE OF TLUs

3.1 Relationship with On-station Research

TLUs are located at the research stations serving the major agro-ecological zones, and are identified by the principal station at which they are located. There is a frequent contact and interaction with the on-station researchers almost on a daily basis. This has been helpful in communicating field problems and performance of technologies on a regular basis. However, there seems to exist a strong tendency for TLUs to rely heavily on varietal testing and adaptation and thus to become extensions of on-station research first and foremost. In the absence of testable (on-the-shelf) technologies related to a range of cultural practices (for example, soil fertility management, weeding, residue management, land preparation-planting methods and so forth), TLUs in general seem to be contending with varietal and fertilizer rate testing on farmers' fields.

In spite of the close contact and linkage with on-station research, there is very sparse evidence of a on-station research agenda driven by observed constraints. Perhaps exceptions are the alley cropping-agroforestry technologies under testing which are not likely to yield results for on-farm testing in the next five years. Although farmers' production systems (mixed cropping with as many as three to five crops, with a complex of practices relating to planting, densities, land-preparation and fertility management techniques; food and cash crop strategies combination, superimposed on strategies to manage risk and labor availability patterns) are highly complex and varied, and thus difficult to experiment with under on-station conditions, attempts to understand the systems and move into mixed cropping-research targeted to a truly representative mixed cropping system have been lacking. Development and adaptation of mixed cropping systems has boiled down to inserting an improved variety into a system with or without fertilizer. This is not surprising given the strength of IRA and NCRE in varietal improvement. However, recent attempts to replicate and/or manipulate the actual mixed cropping systems are noteworthy (for example, on-station work in Ekona, on-farm research in TLU Nkolbisson). This innovative approach should be strengthened and pursued systematically if the mixed cropping production systems followed by 80 percent of Cameroonian farmers (who are classified as small farmers) are ever to benefit from technologies, other than improved seeds.

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3.2 On-Farm Research Activities

TLUs are involved in four types of activities in general.

3.2.1 Surveys

Diagnostic surveys of production systems to characterize the constraints and resources are generally in the form of rapid rural appraisal surveys followed by thematic studies to clarify the nature of constraints. Information from these surveys is used to identify recommendation domains to target technological interventions.

Specific problem oriented surveys such as maize storage, marketing surveys, and so forth are also being carried out to clarify the nature of the problem and economic losses.

Impact/adoption surveys are just beginning to be developed by the TLUs. There is relatively better quality input due to a better quality of extension workers in those organizations.

3.2.2 On-farm Testing

A major portion of TLUs' efforts, personnel, time and financial resources are concentrated in on-farm testing and evaluation of technologies. Three types of on-farm testing and evaluation are carried out. The mix of the type of on-farm tests varies from one TLU to the other.

- Researcher-managed and farmer-implemented tests (RMFI)
- Farmer-managed and implemented tests (FMI)
- Mini-kit tests and regional tests.

These are often large scale, not in terms of "test area size" but in terms of the number of target farmers reached over a large ecological zone.

On-farm tests of both types are designed with input from the extension agency. The quality and intensity of input depend on the technical capacity of the extension agency -- for example, SODECOTON in the North and MIDENO in the North West Province have better trained village extension workers and middle-level extension supervisors. The tests in all the TLUs are implemented in close collaboration with extension agents including selection of test farmers, periodic supervision, and data collection.

It was observed that there is a tendency in several TLUs to design on-farm tests with too many treatments and too many replications. While this is somewhat understandable in researcher-managed tests, farmer-managed tests should be simple and limited to two treatments. The tendency to replicate on the same farmers' field

should be curtailed. A much better capture of variability would be possible if the tests are replicated in the same village or in similar villages.

A similar tendency was observed in "mini-kit" trials where four to five maize varieties were distributed (over 200 kits) with no supervision and follow-up. It was left to the extension agents to supervise and collect data needed for test evaluation by the researchers. It is recommended that seed varieties in the "mini-kit" or regional tests be included only after a certain amount of screening and evaluation in the RMFI and FMI tests and reduction to one or two varieties. A second approach recommended is that of "clustering" of mini-kit trials, a method followed by the Nkolbisson TLU. Once they are clustered, a required sample of tests in each cluster should be closely monitored and evaluated while the remaining tests could be made the responsibility of extension agents. This approach makes supervision of regional trials cost effective to both research and extension agency.

3.2.3. Farmer Evaluations and Feedback

There is a variation in the way farmer evaluations and feedback are obtained and communicated to the researchers. Most often it appears that they are done informally and not always recorded in reports. At TLU/Ekona evaluations are being obtained through a group dialogue with test farmers and workshops. It is recommended that the process of obtaining farmer evaluations and feedback be strengthened and reported as a part of on-farm test results. Even for RMFI tests feedback should be obtained on the usefulness and viability of treatments (economic and cultural viability).

3.2.4 Impact Assessment and Economic Analysis

Economic analysis of recommended technologies on production, productivity, and income at on-farm test stage and their adoption have been largely neglected. Such assessments would have provided additional information on the nature of technology, and nontechnical and policy-related constraints to adoption. Now that the IRA technologies (varieties) have been moving out to farmers during the last two to three years and agricultural economists have been assigned, TLUs should assess the impact of IRA technologies developed under the NCRE project.

3.2.5 Comment on Methodology

TLUs have done quite well in conducting rapid appraisal surveys, diagnosis and delineating homogenous agro-ecological zones within their mandated regions. However, the approach to selection of villages within those zones has been unsatisfactory, not only in an operational sense but in terms of cost effectiveness. While TLU/Nkolbisson concentrates its activities in one village in each of the two zones (forest and transitional zone), TLU/Maroua plans to concentrate in six villages. Similar approach was not observed in TLU/Ekona and TLU/Bambui. Spread of TLU activities in a large number of villages (for example, Ekona 20) is likely to

be less cost effective and would lead to ineffective supervision by the relatively small numbers of staff. It is recommended that TLU coordination unit examine the issue and rationalize the methodology of selection of villages for on-farm testing and regional trials.

On-farm test results are analyzed for production increases in general. In only a few instances, partial budget analysis was reported. It is recommended that future economic analysis include marginal costs and returns analysis to key production inputs (labor, purchase inputs, improved seeds).

3.2.6 Recommendations

1. On-farm testing (RMFI and FMI) should be limited to a few villages (not more than two) in well-defined agro-ecological zones in each TLU.

2. Mini-kits and regional tests within the TLU area should be clustered for effective follow-up and monitoring. A sample of these tests, depending on the needs of statistical analysis, should be monitored by the TLU while the remaining should be monitored by the extension agency.

3. Farmer evaluations and feedback should be systematically collected and reported as a part of the test results. The feedback should include not only opinions about yield and other acceptance factors but also farmer evaluation of treatments for economic and cultural viability.

3.3 Linkage with Extension/Development Agencies

TLUs in general have developed strong working relationships with extension agencies in the area and have performed well in linking research with extension and farmers; and have greatly strengthened the capacity of the IRA to test evaluate to transfer the technologies to farmers through the extension system. This model needs to be consolidated and rationalized with due attention to the overall costs involved.

TLU/Bambui (TLU/B) has strong links to MIDENO, which coordinates the development program in the North West Province through the network of MINAGRI extension system. TLU/B works closely with the two MIDENO organizational units, the Program Monitoring and Evaluation (PMU) unit and the Adaptive Research unit. On-farm tests and surveys have been implemented in collaboration with the extension agents. Mini-kit trials have been completely managed by the extension agents and results reported to the TLU. However returns reporting the results have not have not exceeded 40 percent of mini-kit tests distributed. Similarly, performance of MIDENO/PMU has been unsatisfactory in monitoring programs and assessment of impact (oral communication from the recent evaluation team). It was reported that TLU/B depended on MIDENO/PMU for impact assessment of technologies which it has not done so far. It is recommended that TLU/M work closely with MIDENO/PMU in assessing the technology impact. Failing which TLU/M might have to go it alone.

It is also recommended that TLU/M involve MIDENO/PMU and Adaptive Research units in selecting test themes and designing farmer-managed on-farm tests. A recent evaluation report (MIDENO, 3/89) observed that "the linking of extension with research and trials to define appropriate extension recommendations have been largely unsuccessful." While we have no doubts about the strong links between TLU/Bambui and MIDENO extension agency, such statements appear to justify MIDENO's funding of its Adaptive Research unit and technology demonstration centers.

TLU/Ekona works with the MINAGRI extension agents and the cooperation has been generally good. In addition, the Community Development Department of MINAGRI and Womens Social Welfare Departments have been actively involved in working with women farmers groups. TLU has involved these agents extensively in collaborative activities related to surveys and on-farm research, in workshops and training sessions.

TLU/Nkolbisson works with UCAO and MINAGRI agents in conducting on-farm tests, surveys and regional tests. Although extension collaboration has been satisfactory, lack of resources with MINAGRI and UCAO occasionally lead to lukewarm support and dampened enthusiasm among extension workers.

TLU/Maroua until recently has been working exclusively with SODECOTON -- the cotton development parastatal. With the inception of the World Bank-supported extension project in the two zones of extreme north, TLU has also started working with MINAGRI agents. SODECOTON's technical and financial strength and well-oiled organizational setup, coupled with readily marketable cash crop operations, and clientele with substantially higher levels of technical enterprise, have made SODECOTON more receptive to the potential technological improvements to be gained by a close collaboration with the agricultural research system. This has resulted in close collaboration at all stages of on-farm research. However, recent changes in SODECOTON's financial condition is likely to reduce the level and quality of collaboration. It was reported that SODECOTON has asked that its agents be compensated for the time spent on conducting foodcrop tests (cost to IRA/NCRE per test: 50,000 CFA). It is recommended that IRA/NCRE review the situation at the highest level and not pay the cost of collaboration. Such payment could lead to similar demands from other agencies (MINAGRI, UCAO, MIDENO) which will not only lead to unacceptable increases of research operating costs but will undermine the whole concept of "research extension" collaboration.

Communication is an essential element of linkage. While there is enough of evidence of oral communication between the TLUs and extension agents in the form of various collaborative activities, TLUs have devoted very little resources to develop printed information material on technologies and on-farm test results. This lacuna should be rectified. Such information material would be of immense value in training programs.

3.4 Linkage with MINAGRI/National Extension Service

IRA has entered into written formal collaborative agreements called as "protocols" with extension and parastatal development agencies in each of the TLU-mandated areas. However, IRA link with the national-level MINAGRI National Extension Service is weak in spite of mutual participation in a number of meetings/for a by the top leadership of IRA and the MINAGRI Extension Service. A strong working relationship needs to be established between the IRA/TLU Coordination Unit and appropriate levels responsible for MINAGRI extension operations. This becomes more important as the National Extension Directorate is formed in the soon-to-be implemented National Extension Training Project and two new TLUs are funded under that project.

3.5 Coordination Among TLUs

With four TLUs operating in four different ecological regions, a clear need for coordination among the TLUs has emerged. IRA/NCRE has recognized the need and designated TLU/Nkolbisson with responsibilities for the overall coordination. It is recommended that TLU coordination be strengthened in the following areas and others as needed.

a) An important element of coordination relates to an exchange of experiences gained by TLUs. To this end the TLU coordinator should organize TLU brain-storming sessions to learn and appraise each others' experience, and develop a coherent approach. An annual session preceding the planning period would seem appropriate.

b) Clarifying the terminology among different TLUs.

c) Coordinating or standardizing the on-farm testing formats including the mini-kit/regional testing formats.

d) Planning studies and analysis to provide feedback to researchers, extension agencies, and policymakers.

e) Identifying policy issues related to technology adoption across the TLUs and conducting policy studies in collaboration with the agricultural policy project (CAPP) funded by USAID.

f) Reviewing TLU staffing pattern and assessing long-term training needs to ensure that qualified agronomists, economists, and sociologists/anthropologists will be available to staff TLUs by the end of phase III.

g) Training of TLU staff in methodology and analysis and organizing exchange of experiences between TLUs. Participation of TLU researchers in the regional and international conferences to present papers based on TLU work under the project with due regard to the participation of national researchers.

h) Develop guidelines to improve cost effectiveness of TLU operations and reporting TLU operational costs.

i) Coordinate studies and analysis required to assess economic and production impacts of IRA technologies.

3.6 Project Crop Mandate Vis-a-Vis TLUs

Project crop mandate limiting project activities to cereals has caused some problems in the past relating to the extent TLUs could deal with non-mandate crops (tubers and roots). In the recent past it has been clarified that TLUs could deal with root and tuber crops to the extent those crops are involved in the mixed cropping systems. A similar impression persists in dealing with tree crop (coffee), and foodcrop systems in the North West Province. It was observed that "applied research and senior extension personnel feel that the on-farm work of the TLU (Bambui) only partially explores the range of possible recommendations available to farmers in that it does not cover all possible combinations" (MIDENO Evaluation, 3, 1989). While this does not appear to be a major problem across TLUs, IRA and NCRE should consider such issues on a case-by-case basis depending on the importance of crop combinations in the specific zone/ecology of TLU on-farm research.

3.7 Recommendations

1. Improve the quality and content of TLU and extension agency interactions by providing direction and establishing objectives and involve the extension agency in the selection of test themes, design of tests, and impact assessments.

2. IRA should resolve the situation pertaining to the reimbursement of cost of SODECOTON extension agents' time spent on conducting on-farm tests (foodcrops). The evaluation team recommends that payment of such costs for collaborative work undermines the concept of "research-extension" collaboration and should not be accepted.

3. TLUs should publish extension bulletins on recommended technologies, and results of on-farm tests.

4. To implement TLU coordination, the TLU/Nkolbisson coordinating team should be provided with qualified short-term consultants as needed. First priority should be given to coordinate and rationalize on-farm research methodology, economic analysis of technologies and assessment of impacts.

4.0 COST EFFECTIVENESS OF TLUs

1. 1989-1990 costs of TLU operations (work plan, exclusive of salaries) are indicated below:

	(million/CFA)
TLU: Nkolbisson	13,000
TLU: Ekona	17,575
TLU: M.Bui	6,200
TLU: Maroua	
Total All TLUs	
% of all NCRE Prgms	(37.8%)

2. Approach to the cost-effectiveness of TLU operations should recognize three levels of adaptive research

   a. On-station research for those trials and experiments which require close control and supervision and uniform field conditions -- for example, screening of genotypes, breeding programs, multi-factorial experiments designed to assess interactions

   b. Experimentation in a range of agro-ecological zones with trials of medium complexity (for example, reduced range of cultivers, weed-control studies, fertilizer trials). These could be conducted on farmers' fields if appropriate testing locations are not available. Several OFTs (RMFI) conducted by TLUs are in this category. Relatively few trials of this nature should be undertaken.

   c. On-farm tests of simple packages (based on results coming out of A and B) with one or two varieties with plus and minus inputs compared with farmers' practices. These are farmer-managed tests implemented under farmers' crop-management practices. Verification of extension recommendations also falls in this category.

   d. The final step is demonstration of technologies over a wide area of adaptation, which will be carried out by extension workers with very little supervision from TLUs. The major TLU input at this stage is training of extension workers. Mini-kits or regional trials with very simple test protocols fall in this category. A large number of tests could be implemented with extension participation. These are in fact demonstrations of technologies (proven in "C") on farmers' fields.

3. Another key consideration includes the following:

   a. Number of villages across the zones. Generally not more than two test villages per zone would be involved. If zoning is done carefully representativeness of villages could be assured easily.

b. Surveys: Frequency of data collection in certain kinds of surveys (labor data, marketing-price information) should be decided with careful trades offs of quality, reliability and costs.

4.1 Recommendation

TLU coordination unit devote greater attention to bring about increased cost effectiveness of TLU operations and develop guidelines for the same.

5.0 ACHIEVEMENTS AND IMPACTS

5.1 Achievements

Although TLUs had an uneven start and encountered delays in staffing (TA and IRA researchers) several significant accomplishments have been observed.

1. TLUs are well regarded by their clientele and those evaluating organizations collaborating with TLUs.

2. The TLU concept has become well accepted by the research system and well integrated. Several IRA researchers have gained experience.

3. Some very useful on-farm trials have been conducted and improved varieties of maize, cassava, cowpea, and rice are at various atages of adoption and have been well received in general.

4. Excellent contacts with extension agencies and target farmers have been established.

5. Significant amount of training has been conducted for extension workers.

6. TLUs have, by and large, worked with women farmers who have traditionally been neglected by the extension agencies. NCRE TLUs also benefited by the presence of Cameroonian women researchers on their teams.

7. TLUs have conducted a number of diagnostic surveys to characterize and describe the complex production systems in their zones, identifying constraints and opportunities. This has contributed to improved on-station experimentation and design of on-farm trials and tests. Association of on-station researchers with TLU activities has increased their sensitivity to field problems.

5.2 Impact on Technology Development and Transfer

The impact of TLUs on technology development and transfer is noted at two levels.

Direct Impact: It is quite evident that TLUs have helped transfer IRA technologies, mainly varieties of improved seeds and seed material (maize, rice, cassava, cowpeas, and sorghum). Spotty information is available on the number of farmers adopting improved varieties and area under improved varieties. Field observations also confirm the picture. The varieties and technologies listed below were tested under the NCRE/TLU system and were transferred to the extension system.

Maize: CMS-8501; CMS 8503; TZBP, KSAI; SHABA; COCA; Ekona white; Ekona Yellow
Rice: IR-46; IR-7167; CICA-8; BKN-7033; ITA-222
Cassava: 8017
Cowpea: TVX 3236

Most improved varieties (maize and sorghum) tested and transferred to the extension system are reported to have about 30 -35 percent yield advantage over the locals. Rice varieties grown under irrigated systems have performed well and have shown increased yields in the range of 5.0 to 7.0 tons/ha, depending on the variety and the ecological zone of its introduction. Maize variety TZPB is being grown on about 4,600 ha by the SODECOTN area farmers. Improved cowpea variety TVX 3236 identified in the regional trials of TLU/Maroua is now grown by about 1,000 farmers in pure stands. Fertilizer recommendation of 50 kg Urea/ha for sorghum and seed treatment of sorghum and maize for improved crop stand appears to be widely accepted.

Farmer feedback indicates that there are certain groups in specific localities who have received the IRA varieties favorably. What is lacking are systematic data and analysis of the technologies adopted and of the production and economic impacts. Therefore it is difficult to quantify the impact. It is only now that the TLUs are gearing up to conduct adoption and impact surveys. By the end of 1989 such information is likely to become available. It should also be noted that IRA technologies currently promoted will have only a limited impact at best, because complimentary technologies either do not exist (those related to crop and soil management and cultural practices) or where they exist (fertilizer) they seem to be inaccessible and expensive relative to the farm gate price received by farmers.

Indirect Impact: At this stage of TLU operations, what seem to be significant impacts are those relating to the improved on-station research agenda and information and training provided to the extension and development agencies on both technologies and the technology development and adaptation process. Researchers have started seeing the technology problem from "bottom up" as they have been provided valuable information on the complexity of a mixed-cropping system and a wide range of critical problems. Before the inception of TLUs there were no studies in the provinces which systematically collected, synthesized, and reported on-farm production constraints and production system characteristics to help design both

on-station and on-farm research. At present there is not much that the research system could offer by way of potential solutions to many of the observed constraints. Researchers need to address these problems immediately. Extension agents in the collaborating agencies (SODECAO, MIDENO, MINAGRI, SODECOTON) have become important actors in the technology development process bridging the research and extension gap. This has been widely recognized by Cameroonians as well as by experts visiting Cameroon. This in itself is no small achievement.

5.3. Recommendation

TLUs should devote more attention to studies and analysis to assess socio-economic impact of IRA technologies on production, productivity, and income. Case studies of farmers or groups of farmers benefiting from the IRA/NCRE generated technologies should be developed. In addition, TLUs as a part of their reporting should document impacts on policy and decision making and any other indirect benefits to producers and consumers.

6.0 OTHER ISSUES

6.1 Expansion of TLUs

One often hears that the number of TLUs should be expanded at the rate of one for each province. Also, one hears a certain dissatisfaction that TLUs are not able to cover either the whole region or all production systems (for example, TLU/Bambui). Both the donors and IRA have to be very careful in funding or seeking large scale expansion of TLUs, because of the recurrent cost implications to the national research system and to the extension system where TLU-type activities are funded (MIDENO Adaptive Research Unit with a vast network of trial and demonstration centers resembling parallel research substations where heavy operating and personnel costs have become unsustainable).

The arguments against large-scale expansion within the province to cover all the production systems or to all the provinces are mainly technical and economic. First, foodcrop technology flow is limited at present to improved varieties. Other technologies for production systems improvement are being researched and will take quite some time. Much of the work on this aspect is still experimental.

Second, the recurrent cost situation will not permit expansion either within the province or in all the provinces. We believe under the present circumstances, in general, a TLU can provide strategic coverage in a province if production zones within a province are well defined on the basis of major production areas (contributing 70 percent or more food), major concentrations of farmers (70 percent or more) and market links.

Even in the long run, when there would likely be sufficient technologies coming through the research pipeline, not more than six TLUs, would be the maximum the

IRA and the Government of Cameroon could bear. Six TLUs, well distributed across the major production and ecological zones with strong market links, will be enough to support technology transfer needs. Every provincial extension system and parastatal need not be covered by a TLU. Technologies once tested and diffused in major zones could be further spread by the extension system or will spread themselves as experience in other countries has shown. There will always be certain production systems or subsystems where it will not be cost-effective to install a TLU or it will not be cost effective to develop technologies for those systems..

6.2 TLUs to be Funded Under the National Extension and Training Project (NETP/World Bank)

With the general orientation presented in the preceding sections we support the funding of two additional TLUs proposed by the World Bank under the National Extension and Training Project, with a condition that IRA refrain from recruiting additional staff of any category. The new TLUs should be staffed by reallocating staffs from other IRA units and training them in FSR concepts. Staff assigned to the present TLUs should not be reassigned to the new TLUs to avoid disruption of on-going programs. We do not support expansion of present TLUs to extend their coverage to the whole province.

The NETP is expected to fund two TLUs -- one in the Adamaoua region and the second one in Bertoua (Eastern) -- and provide the provincial extension services with three-four subject matter specialists to strengthen the extension services. TLUs will be required to provide training to the subject matter specialists and will conduct on-farm research in collaboration with the subject matter specialists and re-trained village extension agents. These TLUs are expected to be funded through IRA so that managerial, conceptual and operational integrity of TLUs is safeguarded. USAID and the World Bank need to determine the mechanism of transferring funds to IRA through the NCRE project or through other means when the NETP comes on board.

6.3 Short-term Technical Assistance

Timely and qualified short-term TA needs should be identified in each work plan and technical assistance scheduled accordingly. Work plan should identify clearly the tasks to be performed, duration of the short-term assistance, requirements of a completed product including a seminar presentation at the end of the assignment. Work plan should attach a job description, detailed scope of work, and qualifications of the consultant. This will provide IRA/NCRE management sufficient lead time to identify and bring on board the required short-term help. Performance of IITA, in this as in other programs of NCRE project, has been disappointing, especially given the lack of the economists in two TLUs until recently.

ANNEX I

BREEDING PROGRAM ANALYSIS

ANNEX I

BREEDING PROGRAM ANALYSIS

The scope of work for the breeder was to: 1) assess the plant improvement program in terms of breeding objectives, strategies, and priorities; and 2) critically evaluate the breeding approach or approaches used by each program in terms of IRA resources and level of technology among farmers.

In general, the breeding component of NCRE has made the greatest technological advances thus far in the project. Several improved varieties of rice, maize, and sorghum have been developed and released by the program and adopted by the growers. These varieties have been shown to perform better than former varieties with the same level of input over a range of environments. Better varieties, resulting from the longer-term hybridization and selection programs, are in their final stages of development and show even greater promise. In summary, the achievements accomplished in the first seven years of the project have been exceptional and the team should be congratulated for their efforts. The terms of reference are addressed in detail by program in the following pages.

NCRE RICE BREEDING PROGRAM

Background

Approximately 82 percent of Cameroon's total rice crop is produced by two major and two minor irrigated rice development projects and has provided income for more than 30,000 farm families. The remaining 18 percent is produced as upland or lowland paddy by small-scale farmers in many different areas of the country (Table 1).

TABLE 1

RICE PRODUCTION IN CAMEROON BY DEVELOPMENT PROJECT IN 1987

Project	Area in Cultivation	Percent Total Area	Percent Total Production
SEMRY	11,000 Ha	81%	90%
UNDVA	2,000 Ha	17%	9%
SODERIM	210 Ha	2%	1%
AGRILAGDO	60 Ha	0%	0%

All of the above development projects have the potential to expand total area under production, especially the Agrilagdo project, which has only recently been established. The projects, however, are in great financial debt and facing severe economic and marketing constraints that are further complicated by an increasing lack of farmer services and incentives. In addition, the mills are in very poor condition with no replacement parts or maintenance funds; this has resulted in increased milling costs and decreased product quality. These factors are mentioned because they provide relevant background information for the interpretation of later recommendations.

Phase I and II -- History, Accomplishments, and Areas for Improvement

The NCRE rice breeding program was initiated in 1981 with the arrival of an expatriate breeder based at the IRA/Dschang Station. The program established and continues to maintain ties with IRRI, IITA, WARDA, CIAT, and IRAT (see list of acronyms). The major research thrust of the program throughout Phase I and most of Phase II has been classical variety improvement through germplasm introduction and testing. Targeted impact zones are the Mbo Plain (SODERIM), Ndop Plain (UNDVA), Karewa (AGRILAGDO), and some traditional upland and paddy growers in the West and North West provinces. By the end of Phase I, the program had identified promising paddy and upland varieties for the targeted zones. Phase II activities continued with germplasm introduction and testing and initiation of on-farm testing of the identified promising varieties. These operations led to the release of several varieties in each of the zones.

In general, the released varieties are higher yielding, moderately more disease resistant, and possess somewhat better grain quality characteristics than the former varieties. Surprisingly, however, convincing statistical data on yield, disease, and quality is difficult to find or understand. For example, in most of the annual and compiled annual reports, the number of locations and years used to calculate yield means are different depending on the variety. In the Mbo plain, for example, the released variety, CICA-8 was tested in 9 location x year combinations and used to compare yields with the former variety TAINAN V, which was tested in 14 location x year combinations. This obviously introduces a statistical bias in the results which were evidently used as a basis to release the varieties.

In addition, there is some uncertainty concerning the genetic purity of former varieties. For example, several reports and conversations revealed that the variety, TAINAN V, which was formerly grown in both the Mbo and Ndop plains -- the major target areas of the rice program -- had genetically degraded over the long period since its introduction by the Taiwanese to the present date. This too, could have altered proper genetic comparisons. **It is therefore recommended that, pure genetic stocks of all released material be obtained from their origin and properly maintained. In addition, and in the absence of a National Variety Release Board, the breeder should set up a stronger variety evaluation program complete with guidelines that govern the release of rice varieties in Cameroon.**

Finally, rice seed renewal and multiplication has been neglected as a critical link in the chain from research to grower; this has affected production at the parastatals. Ndop plain records show a steady deterioration in yields over the period when seeds were produced and stored by farmers for the next year's use. No renewal activities were undertaken. At SEMRY, the Mikkelsen report indicates that varietal purity of IR46 has degenerated substantially because of lack of seed renewal. New varieties selected and released by NCRE will suffer the same fate if better seed multiplication procedures are not put in place. **The rice research program should place a priority on renewing breeder seed to provide disease free and pure varieties to rice production schemes.**

Phase II -- Status and Analysis

The NCRE rice breeding program is currently led by a competent and experienced rice breeder, Dr. Monti Jones, who arrived in 1988 after the departure of Dr. Jonnakiram. The team consists of the following scientists:

Dr. Roy	NCRE	Agronomist at Dschang
Mr. Jeutong	IRA	Breeder at Mbo
Mr. Takow	IRA	Agronomist in U.S.
Mr. Fokou*	IRA	Agronomist at Dschang
Mr. Abba	IRA	Agronomist at Maroua
Mr. Asanga*	IRA	Entomologist at Dschang
Dr. Tchatchoua*	IRA	Pathologist at Dschang
Dr. Fobe	IRA	Agronomist at Garoua

* part-time assignments on rice

Before the arrival of Dr. Jones, no crossing program had been implemented during the former rice breeder's seven-year stay. All breeding work was performed by introducing and testing germplasm. This approach has merit in the early stages of a breeding program but is normally reduced once a healthy sample of the germplasm pool has been introduced and tested.

The objective of the program is to increase rice production in Cameroon through the development of superior, high-yielding genotypes which are resistant to diseases such as blast, leaf scald, brown spot, sheath rot, and also resistant to lodging, low temperatures, low light, and possess good grain quality.

In order to achieve these objectives the program has implemented the following operations: 1) germplasm introduction and testing; 2) germplasm characterization, conservation and storage; 3) a cold tolerance and blast screening program; 4) a crossing program using adapted and exotic material; and 5) breeder seed production.

One of the major shortcomings in both the identification of constraints and objectives is the relatively minor emphasis placed on grain quality. Throughout the evaluation team's visit to the major rice producing areas, it was apparent that the

current rice varieties released by the program were far inferior to the imported Thailand rice which sells for significantly less than the Cameroonian rice. Given the already impressive yields and production potential of the major rice parastatals, breeding efforts should concentrate more on improving grain quality characteristics than on yield. **It is therefore recommended that program objectives be redressed to give grain quality a first priority.**

The second priority of varietal research should be blast tolerance or avoidance. While recognized as a major problem, blast screening does not receive the priority it should in current research operations. **More emphasis should therefore be placed on blast research by refining screening techniques and studying the interactions of disease infestation and environmental factors.**

Another shortcoming to be addressed is the allocation of research resources to the target rice production zones. An examination of Table 2 shows that over 70 percent of the research budget is expended in or on behalf of less than 2 percent of the total rice producing areas.

TABLE 2

ALLOCATION OF NCRE RICE BREEDING RESEARCH FUND BY TARGET AREAS OF RICE PRODUCTION

Development Project	Percent Total Production	Research Budget Allocation 1982/7	1988	1989
SEMRY	90%	1%	2%	6%
UNDVA	9%	16%	15%	18%
SODERIM	2%	75%	75%	66%
AGRILAGDO	0%	8%	8%	10%

It is, however, important to note that during the years from 1975 through 1987 CIRAD/IRAT financed a rice agronomist at IRA/Maroua to provide technical assistance to the SEMRY project. Nevertheless, the IRAT scientist was not a breeder and there was little interaction with the NCRE rice project. Although production quantity by area alone should not be the sole factor determining research priorities, it is important, especially in light of the great differences among production zones. If the rice research program is to have a significant impact on rice production in Cameroon, it will have to take place in the North where 80 percent of the total Cameroonian crop is grown. In addition to the SEMRY locations in the Extreme North Province, the Chinese are undertaking a rice irrigation project at AGILAGDO in the North Province that has the potential to develop another 13,000 hectares.

In order to meet the demands of the major rice producing areas through reallocation of research resources, IRA/NCRE should place their rice breeder at IRA/Maroua, where the necessary facilities and support for rice research already exist. A maintenance program could be continued at Dschang for the Ndop and Mbo

plains with the NCRE or IRA agronomist. Mr. Jeutong, currently M.Sc. rice breeder, should receive Ph.D. training as soon as possible to eventually assume the rice breeding responsibilities. It has been four years since he returned from M.Sc. training and no one could explain the delay.

The implementation of the above recommendation also implies that research resource allocation will be shifted from its current 78 percent irrigated to 22 percent upland ratio to 100 percent irrigated, since upland rice production in the North is negligible and declining, despite research and extension efforts expended in the past. SODECOTON records show that only 157 ha of upland rice was grown in the 1987/88 production year.

HIGHLAND MAIZE BREEDING PROGRAM

Phase I and II -- History and Accomplishments

The IRA Highland Maize Breeding Program was initiated in the 1960s by IRAT at Dschang. Research efforts from this program led to the release of the open pollinated variety, Polyhybrid-290, which is still grown in the Western province. From 1970 to 1982, IRA/Bambui maize breeder, Dr. Ayuk-Takem, developed and released several varieties. These varieties, namely COCA and BACOA are still in production in the West and Northwest provinces and are used extensively as check varieties in the current breeding program. The NCRE highland maize breeding efforts began in 1982 with the arrival of Dr. Chung at the IRA/Nkolbisson station. At the time of his departure in 1983, the program had introduced and identified the varieties 'Shaba' and 'Kasai' as promising for the Adamoua plateau and Western highlands, respectively. In 1984, Dr. Les Everett was transferred from IITA/Ibadan to the NCRE Project to continue the Highland Maize Breeding Program at the IRA/Bamboui station. Dr. Everett's first contribution to the program was to transform the Shaba and Kasai varieties into streak resistant varieties which are currently being multiplied and released.

Phase II -- Status and Analysis

The major varietal constraints of the highland zones are: 1) the lack of early and late maturing, white and yellow flint varieties with high yield and improved storability; 2) the lack of suitable maize varieties for intercropping; 3) the lack of high yielding, uniform hybrid varieties for both large and small scale commercial operations; 4) cold climates in the high altitudes; and 5) streak virus and acid soils in the mid altitudes. These constraints were identified in collaboration with the TLU and other extension and marketing surveys. Interviews with the Provincial Delegate, MIDENO, and other agencies confirm that the constraints have been properly identified.

In order to alleviate these constraints, the breeding program has implemented a focused set of operations and procedures. The highland region was divided into a

high-altitude zone (1700-2000m) and a mid-altitude zone (1000-1600m). The mid-altitude zone was further divided between the two provinces, West and Adamoua, due to edaphic and climatic factors. A specific set of breeding objectives and procedures was defined for each of the zones. Generally, the objectives and breeding procedures designed to meet them are well defined and appropriate.

The breeding team consists of Mr. Eta-Ndu, currently in M.Sc. training, Mr. Ndioro, who will begin M.Sc. training in 1990, and Mr. Tabi, who has recently been assigned to the team. In addition, the program collaborates closely and effectively with the IRA pathologists, Mr. Nankam and Mr. Ngoko. Contacts and links with most of the International centers have been established and are good. The IITA maize program leader visits the NCRE breeding programs annually. However, germplasm exchange with IITA is mainly one way, from the NCRE program to IITA, because the Center program has never focused on highland maize improvement. This demonstrates the effectiveness of this program relative to other maize programs with similar objectives.

Research resources have been prudently allocated to address the major constraints and meet the program objectives. The table below shows approximate allocation of resources by breeding operation.

Development of open pollinated varieties for mid altitudes.	45 percent
Development of open pollinated varieties for high altitudes.	15 percent
Development of hybrids	25 percent
Breeder and foundation seed increase and improvement	15 percent

There was some concern in the terms of reference from USAID on the appropriateness of hybrid variety development. The first consideration is whether a genuine demand for hybrid maize exists. In the Adamoua plateau, where MAISCAM has begun a large commercial maize operation from production to product development, all signals suggest that the demand for a high yielding, uniform hybrid exists and is increasing to meet the demands of the industry. MAISCAM, for example, was buying as much local maize as they could to sell to the Yaounde brewery. In 1989 they sold 7,000 tons and could have sold more.

The second consideration is whether Cameroon has the ability to produce the hybrid seed. In this regard, it is doubtful whether Projet Semencier/MIDEVIV, the current GRC agency for seed production, will be capable of producing the hybrid seed based on past history and current financial difficulties. On the other hand, it seems unlikely that any private company would enter such a small and risky market; after all, even though the seed market is increasing, it is still relatively small (<250

mt) and investment costs are high. The only realistic possibility in the short and medium term would be for MAISCAM itself to initiate a small, 30-50 ha, hybrid seed operation on or near their farm. Initial investment costs would be reduced since much of the machinery and other physical facilities necessary already exist, and remaining investments costs would be partially offset by their own savings on seed purchase and transport from Zimbabwe.

Given these considerations, should the maize program be developing hybrids? The answer is yes. In order to attract any prospective seed company or operation, a proven, predeveloped hybrid is necessary to reduce costs of research and development and to produce a saleable product in the first years of operation. Also, it is important to note that the breeding procedure used by the program has been designed not only to develop inbreds for hybrid varieties but simultaneously use the inbreds, through recombination, for synthetic varieties in the same zone. Progress to date reveals that hybrids of equal yield and quality to the best introduced hybrids have been developed. The inbred female parents, however, still need some work to increase their seed productivity. Dr. Everett has presumably corrected this problem and will test several hybrids formed with selected prolific parents this year. In addition, progress on synthetic and open-pollinated variety development for the same region is good.

In terms of progress on mid-altitude varieties, several high-yielding populations have been developed with resistance to streak, rust, and H. maydis. Some of these populations are being tested as varieties this year and show promise. Acid-tolerant populations have been developed fo- the acidic mid-altitude zones and are currently being backcrossed to streak resistant material.

High-altitude variety development is progressing at a slower rate than the mid-altitude program. This is partly due to the paucity of cold-tolerant maize germplasm in the world collection and the lack of previous work in this area. The team observed only one of the three high-altitude sites, the IRA Upper Farm, which is located on the summit of a mountain. Maize plants at this site were only a foot high after almost three months of growth; however, just a few kilometers away, at the same altitude, local maize was observed to be four times the height and progressing relatively well. The problem with the Upper Farm is that it is very acidic and severely deficient in many important elements. **Because of this site's completely uncharacteristic similarity with the rest of the high altitude zone and because genetic effects are masked by its poor and unrepresentative soil, it is recommended that this site be eliminated from the high-altitude variety development program.**

Of all the programs examined during this evaluation, the Highland Maize Breeding Program is one of the most focused and well managed and is poised to make a great impact on Cameroon's maize production. Dr. Everett and his team are to be congratulated for their success.

LOWLANDS MAIZE BREEDING PROGRAM

Phase I and II -- History and Accomplishments

The Lowland Maize Program was established in the 1970s by Dr. Ayuk-Takem, who developed and released several varieties which are still being grown throughout the forest zones, namely Ekona white and Ekona yellow. In 1981, the NCRE project placed a maize breeder at Nkolbisson, Dr. Chung, who introduced new material from CIMMYT, IITA, and other regional and African maize programs. Dr. The returned from Ph.D. training in 1983 and replaced Dr. Chung. Dr. The began an extensive breeding program for the lowlands and developed the early populations from which the CMS material was later selected. Dr. Empig was hired by NCRE in 1984 to assist Dr. The with the lowland and savannah breeding programs and released the varieties, CMS 8501 and CMS 8503. In 1986, Dr. The went to IITA/Ibadan as a research associate and returned in 1987 to replace Dr. Empig and now assumes complete responsibility for the breeding program.

Phase II -- Current Status and Analysis

The major constraints of the lowland forest region are streak, rust, stem borers, acidic soils, and low-light environments. In the savannah zones the constraints are early- and mid-season drought tolerance, streak, and striga. The major objective of the program is to overcome the constraints through the development of high-yielding, disease- and insect-resistant, acid- and *Striga*-tolerant varieties which possess drought tolerance in the savannah zones.

In order to alleviate these constraints and accomplish the objective, the program has divided its breeding operations into four well-focused operations which are listed below by approximate allocation of resources:

Germplasm introduction and variety testing	34 percent
Population improvement for OPs and synthetics	20 percent
Development of inbreds for hybrids and synthetics	23 percent
Development of hybrids	12 percent
Breeder and foundation seed maintenance and production	16 percent

These operations are conducted on three major research stations: Nkolbisson and Ntui for the forest zone and Sanguere for the Savannah zone. Approximately 25

percent of the breeding effort is directed at the Savannah zone and 50 percent at the forest zone, with an operational overlap of about 25 percent. One of the major problems that surfaced during the review of this program was the constraint of technical and financial support for this program coupled with almost unmanageable distances between the target zones. Field plot layout and maintenance are less than optimal due to the magnitude of the breeding operations and inadequate financial support.

This problem, when viewed in light of the large increase in maize production in the North province, suggests that two separate programs with two breeders would be far more effective and have a far greater impact. **In order to remedy the situation in a cost effective manner, it is recommended that NCRE request IRA to move a maize breeder counterpart from the highland or lowland program to the North, and that NCRE provide funds for operations.** This would require minimal expenditure on the part of NCRE and at the same time alleviate an important constraint on the present program.

Another problem which was more evident in this program than others is that of poor seed storage and laboratory facilities. It was surprising to examine the "cold storage" facilities at the NCRE Headquarters. Relative humidity in the cold storage room was over 80 percent and several sacs of maize seed were seen to be rotting. This is just one example of the poor performance in the area of procurement and construction seen throughout the team's tour of facilities. **It is recommended that immediate action be taken by the NCRE chief of party to ensure that proper facilities are made available as soon as possible.** In addition, the Nkolbisson maize breeding farm is a poor site in terms of soil fertility and acidity. The heterogeneous nature of the soil at this site could well impede selection progress. **The maize breeder should consider using this land only for multiplication and acid soil screening until a soil scientist can properly assess the land and recommend appropriate action.**

The question of appropriateness of hybrid variety development again surfaces in this program. Of all the maize producing regions of Cameroon, the forest zone is the least likely to utilize hybrids because maize is overwhelming grown in traditional cropping systems and seed multiplication and distribution in this region are among the poorest in Cameroon. On the other hand, there does exist some potential in the North for hybrid maize, but the timing seems premature. Again, Projet Semencier is not capable of producing hybrid maize seed in the near or medium-term future and especially not on the Sanguere farm. **It seems far more important to put greater effort into *Striga* resistance, which has the potential to jeopardize maize production in the North, than to continue current effort levels in high-yielding maize hybrids.**

Despite the above constraints, the program has made good progress in identifying promising varieties which are ready for release and in developing new higher-yielding OP and synthetic varieties. The greatest impact from the program to date is the release of CMS 8501, which is in high demand in the forest zones, and CMS 8503 for the savannah. The director general for rural development at SODECOTON was impressed with the rapidity with which the program released a

higher-yielding, streak-resistant variety for the North; this variety is already being grown on a high percentage of mono-cultured maize land. In addition, the breeder is making significant progress in developing green maize varieties for the "hunger period" and has initiated a small popcorn breeding program.

SORGHUM AND MILLET BREEDING

Phase I and II -- History and Accomplishments

The sorghum breeding program was originally initiated by IRAT in the 1960s and continued in the 1970s under the direction of Dr. Eckebil. This program developed a red-type, high-yielding variety, IRAT-55, which is still grown by farmers and multiplied by the Projet Semencier. After the departure of Dr. Eckebil in 1975, the SAFGRAD stationed an Accelerated Crops Production Officer who introduced two varieties, 38-2 and E35-1, which were later multiplied and released by Projet Semencier and distributed by SODECOTON. In 1982, the NCRE project placed a sorghum and millet breeder at IRA/Maroua to lead a concentrated effort to improve these crops for Northern Cameroon. The breeder and sorghum program coordinator, Dr. Dangi, is the senior scientist on the NCRE staff and has much experience in sorghum breeding.

Phase II -- Status and Analysis

The breeding program consists of three separate programs, one for each of the three crops, sorghum, Muskwari (dry season sorghum), and millet. The major constraints to sorghum production in Northern Cameroon have been recently reprioritized as follows: 1) lack of suitable varieties and hybrids with desirable quality and agronomic traits such as earliness, drought tolerance and stability; 2) *striga*; 3) diseases including gray and oval leafspots, shooty stripe, anthracnose, grain mold, and long smut; 4) poor grain quality in local varieties; 5) insects such as stem borer, midge and headbugs and 6) birds. The constraints to dry season sorghum were identified as low yields and inadequate post-season moisture. The constraints to millet production were defined as lack of varieties with high, stable yields and early maturity and diseases such as, ergot, head smut, and downy mildew.

These constraints are being addressed through the following allocation of resources by breeding operation and crop:

Sorghum cultivar development through pedigree and population breeding	31 percent
Sorghum variety introduction and testing	14 percent

Striga resistance screening program	6 percent
Hybrid sorghum development	22 percent
Muskwari variety introduction and testing	5 percent
Millet variety introduction and testing	7 percent
Breeder and foundation seed production and maintenance	5 percent

As these percentages reflect, the program is large and resources are being stretched thin. Generally, the sorghum breeding program utilized 75 percent of the total time and resources and the remaining 25 percent is split between millet and muskwari breeding.

The sorghum breeding program initially focused its efforts on germplasm introduction and testing. Material was introduced from ICRISAT, INTSORMIL, India's National Program, and other regional and continental programs. This approach was good and led to the release of several varieties, S35, S34, and CS61. Other varieties from this effort are still in the pipeline. In the mid-1980s the program shifted emphasis from germplasm introduction and testing to active breeding, using mainly exotic material and a few locals. The breeding procedure used was classical pedigree selection. Advanced lines from this procedure are now ready for evaluation and testing.

At the recommendation of ICRISAT sorghum breeder, Dr. Mukuru, the breeding program introduced the population breeding method in 1989. This method has much merit in improving quantitative genetic traits, but should not replace nor take emphasis away from the current method until it has proven to be effective for the the traits under selection in Northern Cameroon. **Greater emphasis should be placed on the incorporation of more local material into the program.** From the results of the 1988 season when several locals, collected by the TLU, were tested with the best released material, many of the locals outyielded the released varieties over five locations.

The development of hybrid sorghums for North Cameroon began in 1984 and is given a high priority in the current breeding program as reflected by the above research resource allocation table. Progress to date has shown the hybrids to be only marginally superior in yield to the released varieties. **Since it is unlikely that Projet Semencier could produce the hybrid seed or that the farmer would pay a premium for it, and in the absence of large commercial sorghum operations, emphasis on hybrid sorghums should be significantly reduced or terminated. Instead, more effort should be placed on *striga* resistance.**

Striga is a severe problem in North Cameroon and the breeding program has addressed the problem through the establishment of a *striga* screening nursery utilizing a standard checker board design. This was a good initial effort but the program should be expanded to screen more material. At present the design only allows for a few lines to be evaluated each year, 11-20. **The nursery should be moved to a better site to allow more material to be evaluated, especially the material resulting from the breeding program which is *striga*-tolerant.**

Another question regarding priorities concerns the amount of research effort expended in the North and Adamoua Provinces. Currently, there is a significant effort, through variety introduction and testing, directed at improving sorghum varieties in the North province and to a lesser extent in the Adamoua province. In the North province, sorghum is being replaced by maize in both the Southeast and Southwest Benoue zones (from Garoua south) at a phenomenal rate. In the northern areas of the North province sorghum still dominates due to the risky nature of maize success in these drought-prone environments. In the Adamoua province, a high grain quality, local variety, Yolobri, is grown by many farmers but maize is fast becoming the crop of choice in this region. **Given these considerations it would be advisable to phase out research in the Adamoua and southern North provinces, concentrating more on those areas where maize cannot grow.** In addition, focusing activities in the Extreme North and northern North provinces will make eventual program turnover more manageable and sustainable for IRA.

Program concentration in the North will also allow the team to focus on some of the many sorghum utilization themes which are needed to build and diversify markets. Currently, the program sends some germplasm to the University at Ngoundere for protein and flour analysis but no utilization program has been implemented according to the workplans. If sorghum is to have a significant role in Cameroon's food economy, utilization will be the door to that future. Areas of research could include breeding for high alfa-amylase sorghums for brewing, parboiling, wheat substitutes for bread, and prepackaged food and confection products.

Progress in millet breeding has not met with the relative success of the sorghum program. Millet has a low priority in the total program as reflected in the research resource allocation table. However, given the large and extended sorghum breeding program, very little time has been expended on the improvement of millet. Breeding efforts have been limited to variety introduction and testing, which to date have had no success. **An economic assessment of the constraints and importance of millet in North Cameroon should be conducted by the TLU economist and the breeding program restructured accordingly.**

Progress in Muskwari breeding has also been slow for the same reasons as millet. However, little research on this crop has ever been conducted. It remains a soil-specific traditional crop with unknown potential. Collection and testing of local varieties has been performed in collaboration with ICRISAT and results from tests show that improvement of this crop will most likely be through agronomic research. **Since there are no breeding constraints apparent for this crop, effort should be reduced to germplasm maintenance and interaction with agronomists.**

Overall, the program is well staffed and has made progress improving sorghum in North Cameroon and should be commended for clear and concise reporting as well as for establishing strong international and regional linkages.

In terms of future contractual responsibilities for the sorghum and millet research program, a priority should be placed on strong technical backstopping and on program restructure geared to high-impact research that is sustainable. The most effective means of accomplishing this task would be for the prime NCRE project contractor to subcontract total S/M program responsibilities to an institution capable of providing effective technical assistance in the areas of food quality and utilization, breeding, agronomy, and economics. In addition, the subcontracting institution should be able to accept the advanced degree training responsibility for the Cameroonian nationals identified for the Ph.D. level in sorghum sciences.

The most effective and efficient "transition" scenario would be to request a waiver from AID/OIT allowing the recently returned M.Sc.-level breeder to begin his Ph.D. in January 1990. Proper justification would have to be provided from IRA and AID Mission. The Ph.D. candidate and his major professor would outline a dissertation research project to be conducted in Cameroon. The 1990 dissertation field work would be implemented under the supervision of the present TA breeder in collaboration with the student and major professor. Course work could be completed in May 1991, and the student could return to Cameroon to conduct the remaining one-year field experiment and assume partial program responsibilities. The other sorghum breeding participant, currently in training, would be returning to Cameroon with an M.Sc. degree in May of 1991. This would allow a phase-out of the current TA as early as 1992. The 1992 S/M field program could be implemented by the M.Sc. with either technical consultancies with the subcontractor or an extension of the present TA. The Ph.D. candidate would return to the U.S. to write and defend his dissertation in late 1991 and return by May 1992, at which time there would be a complete Cameroonian S/M staff.

Throughout the remainder of the NCRE project, technical backstopping would be necessary to ensure a strong effective program and a smooth transition from fulltime Technical Assistance. Again, the objective of the technical backstopping should be oriented to providing the best program guidance and technical assistance possible within the framework of IRA's post-project financial status.

ANNEX J

SOIL SCIENCES ASSESSMENT

ANNEX J

SOIL SCIENCES ASSESSMENT

Covering about 478,000 square kilometers, Cameroon extends from latitude 2 degrees to 13 degrees north. The country has a wide diversity of climates, ranging from the humid tropics near the coast, with annual rainfall up to 5000 mm, to moist savannas in the central region with rainfall in the 900 mm range, to the Sahelian zone in the north, which has a nine- to ten-month dry season and an annual rainfall of 500mm. The succession of climate zones from south to north is broken by intervening mountains and plateau areas which affect both rainfall temperatures.

Climatically, Cameroon can be divided into four main agroecological zones, with subzones within affected by elevation and topography. Soils and best adaptive crops are affected by temperature due to elevations that vary greatly within some of the main zones. The four main agroecological zones can be classified as:

1. Humid tropics - with very heavy rainfall and a short dry season. The coastal region and the mountain region of the west fall into zones where rainfall totals are up to 5,000 mm with as many as 250 rainy days per year; at higher elevation, temperatures can remain too cool for maize and many days with very little direct sunlight.

2. Sub-Humid tropics - includes the forest zones of the south, and the southern reaches of the central savanna area. Rainfall in this zone is between 1,500 and 2,000 mm per year.

3. Sudanese zone - is marked by two seasons, rainy and dry, of about equal length, although rainfall may attain 1600 mm per year, evapotranspirations rates are higher than in the tropical sub-humid zone located to the south. The main maximum temperature varies between 26^{0}C and 28^{0}C and the minimum between 16^{0}C and 18^{0}C.

4. Sahelian zone - having a short rainy season and a long dry season. Total rainfall ranges from 500 mm in the northern sector to 1,000 mm in the south and is distributed over a three-month period. Distribution is highly irregular. Temperature often exceed 30^{0}C and evapotranspiration rates are very high.

Soils associations in Cameroon are very complex because of some relatively recent volcanic activity, parent material, elevation, and topography and climate. The soils in northern Cameroon consist of varying characteristics and, because of the low rainfall, they have not been highly leached. They can be coarse in texture and, thus, have high rates of water infiltration. The extensive former flood plains of Lake Chad are richer and more workable during the dry season due to the water holding capacity of the subsoils. These include the vertisols, which will require special management.

Soils of volcanic origin are prevalent in the Northwest Province and along the northern plateaus of the highland ridge extending southward into the West and Southwest Provinces. These soils are partially laterized and are more workable than the soils derived from granites. Relatively young volcanic soils that are quite productive are found on the slopes of Mount Cameroon.

Most of the soils in the Central and Eastern Provinces are derived from granites and are characterized as Ultisols or Oxisols.

Some constraints to sustainable agriculture production in Cameroon include: (1) acidity problems; (2) nutrient deficiencies, for example, nitrogen, phosphorus, sulfur and magnesium; (3) topography management problems requiring specialized conservation practices; (4) some physical limitations; and (5) problems associated with water stresses. Some soils have high organic matter surfaces and apparently very acidic mineral subsoils requiring some special management options to ensure sustainable production.

Through donor efforts of FAO and OSTROM the soils of northern Cameroon have been extensively mapped and those of southern Cameroon very broadly mapped.

SOIL SCIENCE IN CAMEROON

Soil science research is thought to have begun in Cameroon in 1974 under a FAO project to install a laboratory in Ekona to carry-out characterization analysis in support of soil classification. FAO has not provided active support since 1983. The French government, through OSTROM, supported classification activities from 1983 to 1987. There has not been donor support since 1987. Depending on whose list you use, there are 18 researchers (mostly M.S. degree in soil classification and pedology) in Cameroon. This fits the European style of soil science structure where the disciplines of soil management are considered sciences of agronomy, quite opposite of U.S. division of soil science into 9-10 disciplines.

The National Center for Soils (CNS) was created by order of the Prime Minister No. 59/CAB/PM of 12 April 1983 and is part of the Institute of Agronomic Research (IRA). Its structures now comprise 2 research stations at Nkolbisson and Ekona and two outstations at Maroua and Dschang. Major research sections are: (1) inventory and evaluation of soil resources; (2) conservation of soil and water resources; (3) utilization and exploitation of soils; (4) interdisciplinary of natural resources; and (5) laboratory operations. Supporting units include cartography, data bank, and documentation.

The University Center of Dschang (UCD) also has a laboratory that trains undergraduate students and can complete some analytical services on a fee basis. This was developed by a Belgium donor program that is still in a leadership role. This laboratory has a capacity for labeled routine analyses of 150 samples per month and charges equivalent of $36.00/sample, but has specific prices for individual tests. Supposedly, this laboratory charges the same rates as the CNS laboratory in Ekona.

With respect to functional laboratories in Cameroon, the CNS laboratory in Ekona and the UCD laboratory in Dschang are the most complete laboratories and are, as a matter of speaking, functional. They are not designed to provide rapidly those analytical services required for field soil fertility research and supported to interpretations of a soil test for most economic application of fertilizers for complex soil-cropping systems. These laboratories are simple not properly supplied with appropriate labware to have high volume capacity and thus lower per-unit cost. Long delays in obtaining results from these laboratories and the high cost of analyses have resulted in the NCRE agronomy and TLU programs not using this service, sending some samples to IITA, Ibadan, Nigeria. The corn breeder has been sending samples to the University of Minnesota, USA.

The Nkolbisson laboratory, while having some relatively new space, lacks for instrumentation to support a soil characterization program and necessary labware to conduct those analyses employed in soil-testing program. There is still evidence of the OSTROM program in Nkolbisson with regard to old soil samples, equipment, and chemicals that have been placed into storage.

The CNS laboratory at Dschang, developed by the French some years ago, was non-functional until recently purchased by NCRE of some minor equipment and labware. This laboratory, while being able to provide some analytical support to field projects, cannot be classified as a functional laboratory. The CNS laboratory at Maroua was found to be completely non-functional, a few old pieces of equipment to support characterization analysis and some glassware. Any program support from this laboratory would require space renovation and purchase of labware, instruments, and supplies.

Soil analytical methods used in the laboratories originate from a FAO manual, modified for the Cameroon environment to fit the FAO, French, and Belgium project requirements. The plant analysis methods to support the parastatal export cash crops are also though to come from FAO or European sources. The concept and knowledge of soil testing and plant analysis methods and their interpretation from calibration data for economic fertilizer recommendation, and the gearing up for any economics of capacity volume, do not now exist in the Cameroon programs.

There is, for all practical reasons, no information available from which the soil scientist can base a fertilizer recommendation after completing a routine soil test. Some interpretation information for foliar analysis of parastatal cash crops to provide some balance to fertilizer requirements does come from literature from other countries. This lack of basic soil fertility background data resulted in the two most common fertilizer grades being imported [21-10-10 and 21-0-0 (ammonium sulphate)] based on a 1974 FAO best catch-all fertilizer material for the parastatal cash export crops. The control of fertilizer imports for the parastatal crops, and the lack of an open market, have resulted in high, by international standards, per-nutrient-unit cost, with some farmers are purchasing single nutrient grade materials from Nigeria.

The soil science program in Cameroon, in addition to deficiencies in labware, instruments, professional staff, and physical facilities to adequately support a soil characterization and the parastatal programs, is also most lacking in being able to

add a broader science base to cereal and food crop production -- let alone sustainable agriculture and natural resource management -- and to collaborate with forestry-based farming systems.

SOIL MANAGEMENT GAPS IN THE NCRE PROGRAM

This information was collected from visits with all cereal crop breeders, agronomists, and TLUs and visitation to the IRA laboratory centers at Nkolbisson, Ekona and station laboratories at Dschangs and Maroua, visits with Dr. Jacob A. Ayuk-Takem, Director of IRA; Bindgi Ekola Joseph, Chief of Soils Centers; Dr. Kenneth S. Fisher, Deputy Director of Research of IITA. Other documentation was found in the 1987 USAID/Mission evaluation of NCRE Phase I and 1989 Fertilizer sub-sector report.

The maize breeding program has soil chemistry and fertility-induced constraints that directly influence both breeding and variety trials because of site-specific soil problems. Broadly these problems can be focused on: (1) soil acidity and exchangeable aluminum; (2) soil compaction problems; and (3) soil effects on available primary nutrients (N, P, k), secondary nutrients (Ca, Mg, S), and some micronutrient imbalances (Zn, Mn and Fe). Problems identified on the rice breeders site on the Mbo Plain can cause high replicate variability due to high soil spacial variability from soil chemical-physical differences to render variety trial data of less than desirable utility. Observed soil variability on the new IRA station near Maroua cannot help but cause high coefficient in variability due to replication on the sorghum/millet breeding and variety trials, and other on-station agronomy work.

There is a need to develop fertilizer response curves or response surface data to enable recommending fertilizer nutrients on a required nutrient input basis to generai data for the most profitable production cost technology. This could be a joint activity of the cereal agronomist and the agronomist serving on the TLUs. Present soil fertility research is essentially fertilizer rate trials designed based on available nutrients and not based on developing the necessary information needed to recommend fertilizer applications based crop need and the capacity of the soil to supply that need. The components in laboratory support system and scientific counterparts to characterize experimental sites, sample, and analysis for available nutrient levels and calibrate crop response to soil available nutrients do not exist in Cameroon. Focusing on-station and on-farm fertilizer trials to generate soil test calibration data to offer a soil testing system geared to profitable and selective use of fertilizer would facilitate the cereal production agronomist and TLUs to broaden their recommendations domains.

Special nutrient imbalances reported by cereal agronomists have been difficult to work on because of lack of support laboratory facilities. Deficiencies though to be Mg, S, and Zn and toxicities thought to be the caused from Al, Fe, and Mn were all reported during field visits.

In the northern provinces, soil degradation and abandonment are reported becoming even more visible. Large areas with sparse vegetation without trees and/or shrubs are amply visible evidence of lands previously cultivated and abandoned because of the lack of sustainable production systems. This is decreasing the area of virgin land, available native fuel, and construction materials and is encouraging desertification in the extreme north. Presently, there are two scientists funded under EEC who have plotted rainfall quantity/intensity, and measured runoff on a degraded bare abandoned soil and on mulch cover soil. The soil, once degraded to not support vegetation, becomes very compacted with low water infiltration rate resulting in 70 percent runoff that causes erosion even on this relatively flat topography. Loss of water by runoff also will reduce the water stored in the soil and can increase water stress on plants during short dry periods that can reduce yields and response to other management practices.

The dynamics of soil degradation of the soils in the savanna regions renders some soils non-productive because they are especially fragile to mismanagement. The savanna soils, can be acid in some areas and some have high phosphate fixation capacity. They are low in organic matter and have low cation exchange capacity. Rainfall can be high in both quantity and intensity during the wet season; this is ideal for high erosion of soils not properly managed. Land clearing for the expansion of cotton-maize-groundnut production is observable on the savanna regions. Land degradation caused by poor management practices is evident in these areas to the point where native trees and shrubs have been reduced so that wood for fuel and construction is now scarce and expensive. Lack of the capability to address the production of the major food and fiber crops in this region in light of a holistic approach to sustainable production through development of options in natural resource management can only result in increased soil degradation and shifting cultivation. This will result in a decrease in the production capability of food, fiber, fuel, and building materials essential to the society of northern Cameroon.

Lands in West and Northwest provinces of Cameroon are typified by very hilly topography, under high rainfall and very intensively cultivated because of high population density. Some soils in this area are black and can be highly productive, but the black color is not always due to organic matter levels. Improper soil-cropping management practices are causing high visible levels of erosion, some of which farmers try to compensate for. The TLU at Bambui learned from survey that farmers mound the topsoils in which to plant to keep as much of the roots away from the compacted and acidic subsoil. The space between their mounds increases each year because of loss through erosion. Complex cropping mixtures appear beyond the present capacity of the NCRE to address the cropping systems, let alone complexities of risk reducing soil conservation practices especially tailored for this humid tropic zone.

SOIL MANAGEMENT PROGRAM INFRASTRUCTURE NEEDS

The following are recommendations based on field visits and understanding of the physical structures and personnel available to conduct soil management research. The following infrastructure investments are recommended:

1. Nkolbisson - This should be the CNS central laboratory location that can serve the broadest number of research/service and training functions in the country. This should have the necessary labware, instrumentation, data processing, support facilities, and space to be the national hub around which research, service, and training programs can function. This will need to be put together as the need arises. Initially, it should be able to serve soil fertility programs, that is, soil and foliar analysis, characterization analysis, and some support to soil biology programs. This does not imply the latest state-of-art high technology equipment used in many quality U.S. land-grant universities, but basic durable PH meters, colorimeters, atomic adsorption spectrophotometer, hand operated dispensers, digestion blocks, and the like that have been found to be very serviceable and require limited maintenance.

This would require both structural modification of the present CNS facilities and importation of labware, equipment, and the like. Specific equipment needs are beyond the scope of information needed in a project evaluation.

2. Ekona - The Ekona laboratory appears to have received the greatest quantity of equipment during the period of the FAO program to support soil characterization and classification programs. To support soil fertility field programs, their immediate need is for labware to streamline their nutrient extraction procedures and develop some soil analysis (soil testing) throughput volume capacity. This laboratory now charges $36.00 - $45.00 per sample for what is labeled as a routine analysis. This is in the range of 9-10 times higher than costs for very similar analysis in the United States. The Ekona laboratory has much of the basic instrumentation, but would benefit through purchase of lamps for its atomic adsorption spectrophometer unit to enable analyses of more of the micronutrients, soil grinders to speed up soil preparations, and the like.

Maroua - This laboratory is non-operational as far as being able to provide support to a soil fertility field research program and provide the necessary support to other agronomy research. The laboratory was originally designed to support the soil classification program and appears to not have been of service for quite some time. The NCRE project, active since 1983, has never been able to use this facility and has shipped a minimum number of samples to IITA, Ibadan, Nigeria.

This laboratory should have necessary infrastructure modification and equipment to serve as a satellite laboratory to complete those analysis needed for soil testing, or availability of plant nutrients to facilitate the soil test correlation and calibration programs. In addition, capability to determine soil salinity might be necessary at this IRA center.

This should provide IRA-CNS a cost-effective laboratory network to serve soil fertility research programs and generate the necessary soil test calibration data to support economic fertilizer recommendations. The laboratories should also be able to make available a soil test and P. lost analysis service at a much more affordable level that is presently available in Cameroon and probably in all of West Africa. This is a service that should be promoted, especially by a parastatal such as SODECOTON.

It is also recommended that quality control of analyses and overall coordination as a national program be a charge to the center at Nkolbisson.

SOME SUGGESTED RESEARCH PROGRAM NEEDS

Because of the diversity of agroecological zones, but similarity of some basic soil management research, thrust with analogous objectives for regional specificity must be considered to best supply Cameroon with agronomically, ecologically, and economically sound soil management technology.

1. Soil Test Correlation and Fertilizer Response Calibration

The NCRE cereals and TLU agronomists are conducting fertilizer response trials attempting to develop N, P, and K response surface data from which to make most economic fertilizer recommendations. Their experimental designs are not always correct. The program lacks the necessary soil analysis back-up support so the research efforts will allow the data bank to interpret a soil test for high probability to or not to respond to N, P and K fertilization based on crop need and ability of the soil to supply some or all of the crop nutrient requirements.

This research program would require evaluation to select the most suitable chemical extractant(s) that correlate highest with plant available nutrients of Cameroonian soils. Preferences would be given to the extractant that could rapidly and with respectable precision extract many of the primary, secondary, and micronutrients for cost-effective use of labware, chemicals, and laboratory personnel. This part of the research could serve as a training activity and would serve for a M.S. graduate thesis project.

The development of field calibration data could most cost-effectively be collected in linkage with the on-station and on-farm fertilizer response trials, especially N, P, and K. Basic landscape position and soil characterization of sites would be important along with pre-treatment surface sampling, followed with later sampling if fertilizer was broadcast. It would be preferred to establish four to five locations as primary experimental sites for experimentation with satellite annual plots around the area of the primary experiments. Treatments would have to be based on available nutrient levels of the pretreatments sample so as not to carry along unnecessary treatments. Calculation of yields to a relative basis would facilitate pooling of experimental sites and calculation of response surfaces over available

nutrient levels. Continuation of the experiments over four to five years would enable evaluation of residue effects, especially P and K treatments for total cost/benefit assessments of the initial fertilizer application.

Calibration of the secondary nutrients, Ca, Mg, and S and micronutrients, Zn and maybe others, would best be completed on an identified need bases. Some areas where potential research will be needed on secondary and micronutrients is the north and northwest provinces

2. Soil Acidity Research

Other than verification, there appears to be very little research on plant growth and productivity constraints due into acidity. Restriction in crop options appears to be most related into soil acidity. Some observations by plant breeders have identified high exchangeable Al, Mn, and Fe toxicity problems associated with acidity. Suggested deficiencies in Mg and potentially Ca (with high organic matter soils) are also associated with acidity. Farmers in the Northwest Province cultivate their soils into large mounds and plant on the mounds to compensate for loss of surface soils by erosion, thus maximizing the benefit of the remaining topsoil. The farmers have found through experience that poor growth and yield occur when crops are planted on shallow or on subsoils.

There are two aspects to mitigating soil acidity in Cameroon. Limestone apparently is not common in Cameroon; it is found in small scattered pockets and is expensive and difficult to purchase. A cement factory by-product is being tested as a liming material. The quantity and quality of material appear to be unknown. Without calcium-magnesium carbonate liming materials to overcome soil acidity problems, this research thrust must investigate other options in soil-crop management. Use of legume fallow systems utilizing the biomass as the incorporated amendment offers a potential management alternative to ameliorate problems of soil acidity. The unification of the topsoils ACID4 computer based decision support system for Cameroon soils could be of assistance in cost/benefit analysis of soil acidity reduction.

3. Soil Management Focusing on Conservation Technology

These programs, while having a central focus to promote soil conservation and sustainable production, will need to develop very specific water-shed and landscape management technologies. A first step would be to use the available natural soil classification system to make some direct interpretation for specific uses through adoption and use of the Fertility Capacity Soil Classification (FCC) system.

3.1 Soil management technologies of mixed maize-coffee cropping systems of small farmers in the western, volcanic highlands. Specific problems to be addressed include interpretation of nutrient requirements and management soil-water management systems to reduce soil erosion, and cropping options to minimize off-farm input purchases and maximize productivity.

3.2 Soil Management of the maize-cotton-cowpea-groundnut cropping system of the northern savanna region. Specific problems to be addressed should include but not be limited to the role of green manures as alternative sources of nitrogen in cropping systems, efficient use of water and nitrogen, improved nutrient management, potential for mixed fuel-fiber-food cropping systems that focus on production sustainability, and prevention of soil physical degradation that leads to soil erosion and land abandonment.

3.3 Improved soil management options for the mixed food crop systems and maize-groundnut cropping systems on the Ultisols and Oxisols of the humid southern regions. Specific problems include developing low-input, sustainable systems that minimize environmental degradation.

3.4 Sustainable soil management cropping systems of the sorghum and millet based monocultures in the northern semi-arid region. Because of emerging shortage of fuel and history of shifting cultivation due to soil degradation, research should focus on water-soil conservation, nutrient cycling and management, and mixed annual crop-tree cropping systems to maximize limited water resources.

These soil management research programs would be most productive with integration into the agroforestry, cereal crops, root and tubers, and cash crop production research programs. Selective and evaluation of legume species to be utilized in green manures and soil-protecting cover crops would need to include collaboration with the program in genetic collection and preservation.

TRAINING NEEDS

A definitive training program will require the evaluation of available technical human resources within Cameroon, the formulation of which is beyond the scope of this NCRE evaluation. The latest list of scientists in Cameroon indicates 18 soil scientists, but does not break this list down by discipline and degree. There is a strong indication the major past training emphasis was on pedology and classification. Future training would need to reallocate emphasis to build upon the present strength on pedology and classification to bring balance to the discipline of soil science.

Available information suggests, only two or three M.S. candidates in the soil chemistry-fertility disciplines, one M.S. in training who will probably emphasize soil management, and one PhD candidate in soil chemistry. For IRA to develop a balanced program in soil management would require development of a critical mass in the following disciplines:

- Soil fertility
- Soil physics
- Soil and water conservation
- Soil chemistry
- Land use management

The soil laboratories would need an overall manager in-charge, with minimum of an M.S. degree in soil fertility and some specialized training. To develop this critical mass would require a phase-in of five to seven years, based on availability of candidates and ability of IRA to absorb most of the recurrent costs.

ANNEX K

AGRONOMIC ANALYSIS

ANNEX K

AGRONOMIC ANALYSIS

INTRODUCTION

The Agronomist's scope of work called for a general review and assessment of the overall agronomic research conducted under the NCRE project in terms of its relevance to production constraints and problems. Special emphasis was placed on the issues of sustainable agricultural production systems; research facilities adequacy; research coordination among separately funded cereals, roots and tubers, and grain legume projects; overall research management issues; and, whether the existing research mandate of the project required modification.

Sustainable Agricultural Production Systems

As discussed in the Breeding Program Analysis Annex (Annex I), the cereals agronomy programs, and substantial portions of the TLU-managed, on-farm trials and mini-kits, support the dominant varietal improvement (yield increase, disease and stress tolerance) thrust of NCRE's applied research. Most of the released varieties of maize, rice, and sorghum have demonstrated their ability to outyield older varieties at equivalent input levels and across average-to-good production environments. Some of the released varieties even outperform the older varieties on low-productivity sites where local materials generally have an advantage. These characteristics are favorable to the adoption and diffusion of the new crop varieties. As a biological input which can be preserved at the farm level for several years, seed of improved varieties can be seen as an effective and sustainable way of increasing farmers' land and labor productivity. However, NCRE researchers are aware that the potential impact of the higher yielding varieties may be to increase nutrient export from the soils. With the exception of some of the volcanically derived soils, a few areas of colluvial soils in valleys, and some of the alluvial river valleys, most soils in Cameroon will show relatively rapid declines in yield from steady cereal cropping unless soil fertility is maintained through soil amendment.

Much of the cereals agronomy trial program is oriented to the problems of soil fertility management and maintenance. The work plans show a laudable concern for the problems of identifying ways to reduce the cost and potential negative side-effects of excessive or improper fertilizer applications, the search for bio-organic supplements and complements to imported fertilizer materials, and the incorporation of leguminous rotational crops, green manures, and perennial alley species in cropping systems. However, as the TROPSOILS soil specialist points out in Annex J, the agronomy programs lack the soil science support needed to identify specific nutrient requirements, probability of response to amendments on different soils, and actual causes of observed crop responses. Therefore, a large portion of the on-station and off-station trials on fertilization, liming, manure application, green

manure, crop rotation, and alley cropping work is inefficiently designed and difficult to interpret.

In the humid forest zones and the highland maize areas, there has been a significant amount of effort on alley cropping and agroforestry approaches to developing techniques to permit longer useful field life. These trials have made substantial progress in screening tree and shrub species for their adaptability to specific sites. Important experience has also been gained in manipulating the tree species. However, many of the trials appear to have been designed without sufficient bibliographic review of experience on the same species in similar agroclimatic conditions.

Agroforestry and alley cropping research has advanced considerably over the last decade. Researchers in other parts of the world are finally characterizing and quantifying nutrient flows and looking at the true costs of improved fallow systems (Peru); tracking labor, input, and power requirements and specifying benefit streams to examine cost:benefit relationships (Indonesia, Philippines); and determining alley cropping component interactions (many sites). The recently arrived Lowlands Maize Agronomist has brought with him experience in the use of *Cassia spectabilis* on Rwanda hillsides. He has introduced this species into on-station trials in the humid lowland areas. While *Cassia* species have wide ranges of adaptation, the Lowlands Maize Agronomist has felt constrained by his terms of reference to use this species in an environment which is suboptimal for it. The structure of his budget appears to prevent him from direct collaboration with the Highlands Maize and Bambui TLU where his Rwanda experience in hilly, high-population-density areas would be more useful.

All NCRE agroforestry designs and interpretation seem to have neglected the issues of analysis of labor requirements and competitiveness with fertilizer as a source of soil amendments. All are constrained by inadequate soils information and soil testing services. Little consideration has been given to alternative spatial arrangements of tree crops for agroforestry applications. Perhaps most importantly, the agronomists working on these trials have not done a review of the role of trees in the landscapes and cropping systems around them which might have modified their approach. No agroforestry work is being done on sloping land or with economically important tree crops (coffee, cocoa, plantains) on sloping land. While some TA researchers are of the opinion that only leguminous trees and shrubs should be used in an agroforestry system, this perspective flies in the face of observed current farmer practice which is based on the perennial fruit and beverage tree crops, mixed fruit and wood lots, and, in the West and Northwest, eucalyptus wood lots and fence lines.

The ICRAF program is just getting established in Cameroon. NCRE should be commended for providing the ICRAF/IRA program with office space in Nkolbisson and collaborating with them. At the same time, the ICRAF alley cropping collaborative trial that was visited leaves much to be desired. *Gliricidia*, *Leucaena*, and *Cajanus* hedgerows were established in 0.5-meter-wide cleared strips on an already established tall-grass fallow to increase biomass for later incorporation. The grass outcompeted all species except *Cajanus*, which suffered reduced flowering from

competition with the tall grass. Far more biomass production and soil stabilization seemed to be occurring on the natural tall grass fallow area than in the hedgerows. The high clearing and weeding demand of this establishment and species selection did not impress a group of women farmers who had seen the site. When asked if they knew of anything which grew more quickly, one woman responded that she had planted plantains at the same time as the trees and already harvested and sold her first production. If this trial is representative, which it hopefully is not, ICRAF may not be the best source of agroforestry expertise for NCRE purposes because of the rigidity of its designs. ICRAF would not modify its treatments, despite NCRE staff requests to reconsider the design. It would have been more appropriate, for example, to establish these trees and the pigeon pea shrub on land just going into fallow, when weeding requirements and fallow species competition would have been lower.

The rice agronomy sub-program devotes about 16 percent of its budget to crop diversification studies, including rotations and intercropping, and green manure trials. These are beginning to show that some areas considered to be predominantly rice areas hold substantial promise for other dry-foot crops. The agronomy team should be congratulated for its work on diversification, which may have important economic implications for rice growers who now find themselves with severely reduced marketing opportunities. The evaluation team does not know to what extent the NCRE rice diversification duplicates or complements the work done by the French agronomist previously charged with diversification research on the Semry perimeters. Work done on a *Crotolaria caricea* as a green manure crop shows technical promise but has not been subjected to serious economic or operational evaluation for its adaptability to parastatal or independent producer conditions.

In the subhumid and semi-arid savanna zones of the North, crop rotational and intercropping work focuses on grain legume intercropping. Substantial attention has been paid to the problems of soil and water conservation both in the preceding SAFGRAD trial programs and in the sorghum/millet and general cereals agronomy sub-programs of NCRE. These have included work on minimum and zero tillage, alternative land preparation equipment, tied-ridging, mechanization using animal traction equipment, among others. The cereals agronomist should be congratulated for persistently calling SODECOTON's attention to the problems of intensive use of disk plows as primary tillage tools on the sandy alfisols around Garoua. There has been a happy coincidence of soil conservation objectives with the need for SODECOTON to reduce operating costs at the parastatal level and in the cotton farmers' food crop rotation.

A micro-watershed management trial on 2.3 hectares of land which combines graded fields, water ways, and a small earthen tank for supplemental irrigation is being carried out by the sorghum/millet agronomist on a vertisol site. It is modeled on the ICRISAT microcatchment technique researched in India. It is being intensively managed, including the use of a *Crotalaria* green manure crop, for double cropping studies combining various rainy season crops with a recessional Muskwari sorghum crop. Development of the site cost about $1,600 per hectare. The 1989 workplan allocates nearly 34 percent of the total sorghum/millet agronomy budget to this trial. While the trials are consistent with the sub-program goal to develop technologies capable of supporting high and stable sorghum yields, this level of investment does

not seem proportionate to the needs of the overall NCRE program thrust which seeks to develop technologies adapted to smallholder needs. Tough technical and economic questions need to be asked of the sustainability of this approach. It seems unlikely to serve as a model from which components could be extracted and extended. Also, its high operating cost decreases the agronomist budget available to do on-farm trials.

RESEARCH FACILITIES ADEQUACY

Humid Lowlands and Transition Zone Programs

Nkolbisson facilities for the NCRE project can be divided into two categories. The first, office space, is generally adequate, although the TLU space is being rapidly filled by new assignees to the program. The second category, supporting research facilities, is inadequate. The seed storage at Nkolbisson for the Lowlands Maize Program is totally inadequate to the task of short- to medium-term preservation of seeds. The drying floors available were constructed for the coffee and cocoa programs. Given the high rainfall in the area, a sheltered drying space and a drier are needed. Work space for trial preparation and temporary storage and handling of harvested plots is insufficient. As the soils annex (Annex J) points out, the current soils laboratory is set up as a characterization laboratory, not the medium-volume soil testing laboratory needed by agronomy and breeding programs.

Ekona Center office facilities are totally inadequate. The TLU occupies laboratory space intended for the Ekona pathology unit and staff are crowded three to a room. All Ekona/TLU and the zone-specific Lowland Maize Agronomy trial materials are also handled in this space. Once again, seed storage, sample drying, trial preparation, and general storage space are inadequate. The Yoke antenna has no field shed or shelter. The TLU at Ekona should be congratulated for making the best of a poor situation.

The soils laboratory at Ekona is described in the soils annex (Annex J). It is a characterization lab. Its principal clients are the plantations, which have first priority on the laboratory services (the Ekona station was originally established to support plantation agriculture, predominantly rubber.)

The Ntui substation is located on a Mideviv farm in the transition zone. Worker housing and some storage space is available, although the storage space is in poor repair.

Rice and Highlands Maize Programs

NCRE activities at Dschang are devoted to rice breeding and rice agronomy/crop diversification. Dschang station has a wide set of facilities which were built to support coffee, chinchona, and vegetable crops. Two diesel-fueled forced-air driers exist, one of which works. A significant portion of the stations

facilities is given over to grain legume research supported by CIRAD. NCRE has rehabilitated office space for the breeding program and constructed a small greenhouse for cold screening of rice varieties. The agronomy program is located in a laboratory converted into a soils facility. As the evaluation team is recommending a shift of the rice program to the North, there is little reason to pursue a construction program at this site.

The rice program has invested in facilities at both the Mbo Plain (SODERIM) Santchou substation and the Ndop Plain (UNVDA). At Santchou the project has constructed a seed store. Drying and work space is inadequate for the size of the program, but the evaluation team is recommending that activities at Santchou be greatly reduced, which should relieve the stress. The rice seed store was not a major investment and can be abandoned if the rice program moves to Maroua. The Ndop Plain facility is a warehouse used to store materials and equipment. It is in good condition and sufficient for substation use. Field management is a problem at this site as the agronomy and breeding programs do not coordinate plot use. This year, a first-season, fertilizer-by-maize-variety trial was planted on land that the rice breeding program had intended to use for varietal screening. The breeders did not know that the trial had been placed on one of their main selection plots.

Bambui station has extremely limited office and laboratory space. The pathology lab is so crowded that equipment has to be moved around so doors can be opened and closed on incubation chambers. Space is so restricted that some equipment is kept, unused, in a closet. The highlands maize breeder has rehabilitated some space to use as an air conditioned seed store. This has served relatively well, primarily because of the careful drying of seed which is done using a wood-fueled convection drier. But it is not acceptable seed storage for maintenance of germplasm collections. Also, the drier capacity does not permit both breeding program and agronomy program plot samples to be dried simultaneously. The agronomy program is currently constructing a drier at Mfontah substation to resolve this problem. Work space for trial preparation and sample handling is very limited. Laboratory, work space, and improved seed storage facilities should receive the highest priority for construction at Bambui.

Bansoa, Mfontah, Babungo, and Upper Farm substations and the Foumbot station were visited. Bansoa has no field shed or shelter. Mfontah is reasonably well equipped in terms of sheltered space. Babungo office and storage space needs rehabilitation and the addition of storage space for harvested trials. Foumbot station has no resident researchers and has an air of neglect on the portions of the station not used by NCRE. Field sheds, storage, and office space exist, but the older buildings require rehabilitation. The major facilities problem at Foumbot, however, is farm management. The IITA maize breeder has had to resort to suboptimal time isolation of trials, because the station director has permitted uncontrolled planting of maize over the entire station. While the team was informed that there was a station management committee within IRA, its existence is in little evidence at Foumbot.

The highlands maize breeder indicates that increased efficiency in breeding could be achieved if a maize streak virus screening facility were constructed to permit the rearing of *Cicadulina mbila* to permit intensive stressing of maize

materials. Only at Foumbot during the dry season are natural leafhopper populations sufficient to ensure relatively high levels of streak pressure.

Northern Sorghum/Millet and Cereals Agronomy Programs

The Maroua Center has extensive facilities and experimental field surface area. The climate of the area reduces the need for artificial drying of crops and storage problems are reduced. The sorghum/millet breeding and agronomy subprograms are located in a building constructed two years ago under the World Bank project. The quality of the construction is awful. Walls and floors have wide cracks in them. There is reasonable laboratory space for trial preparation, but there is little space for handling the large volumes of plot material. Plot material handling and threshing space is shared with the TLU. With the arrival of the TLU agricultural economist, there has been a loss of working and storage space. An insulated seed storage unit is needed at Maroua. The current uninsulated seed room requires exceptionally close management (manual venting at intervals) and the high energy demand for cooling has worn out six air conditioners over the last six years. The defunct soils laboratory at Maroua is described in Annex J.

The major problem at Maroua is the decision to build the provincial hospital on the Guiring experimental farm. This site is well managed, has relatively uniform soils, and is minutes from the laboratories and offices at Maroua. To replace Guiring, IRA was ceded 600 hectares of land at Mouda. The site is 30 kilometers from Maroua and has no facilities except a temporary field shed constructed with funds from the budgets for experimentation from the sorghum/millet program. While there has been a soil survey, no results or soil map has been received. No topographic survey has been done of the site. Consequently, the researchers are clearing and planting land with little information about the soils. It is apparent that the soils are highly variable on this site, ranging from vertisols at the footslope of hills adjacent to Mouda to oxisols on lateritic carapace. Extensive mixing of soils is apparent in the B horizon of soil pits on the part of the new station that was visited. Trial plots in the sorghum/millet and cowpea agronomy trials are planted on a site where soil depth varies from 75 cm to under 20 cm. Workers are having to clear lateritic cobbles and aggregates from trial plots before planting. While the team cannot judge if the same degree of spatial variability exists across the 600-hectare site, it seems evident that large areas of the Mouda station are not appropriate for controlled field plot work.

The office and lab space allocated to the Bean/Cowpea CRSP research at Djarengol seems adequate for the work being done. The principal lack is an insectary to raise bruchid beetles.

The Soucoundou substation was visited briefly en route to Garoua. It is a typical substation from the World Bank supported project, with a combined office, warehouse, workshop and a perimeter fence.

The Garoua-based cereals agronomy program is a bit of an anomaly in the NCRE program in terms of facilities. It is situated in an area where sorghum and millet surface area is declining, where large development programs in rice are under study, and where maize is growing in importance. The NCRE program is lodged in a house in Garoua which has been slightly modified to serve as office and laboratory space. The CCCE-supported Projet Garoua is beginning construction of a research station at Sanguere. USAID is also scheduled to build office and storage space at this site. This site has no experimental farm adjacent to it. Instead, a series of substations provide sites for field experiments. The cereals agronomist has established a field site near the Djalingo substation where trials on seed treatment, fertilization, Striga management, green manures and crop rotations are done. A simple field shelter has been constructed with funds from the cereals agronomy budget. The Djalingo substation is equipped with a combination field shed/office constructed under the World Bank project. This official IRA substation is located on a slope. Its farm land is divided in block by grassed bunds to reduce soil erosion. The SODECOTON sector head's office, warehouse, and residence is located across the road from the Djalingo station.

The team visited the Karewa irrigated station which was funded by the German aid agency (GTZ) and operated by the Mission d'Etude de la Mise en Valeur de la Vallee de la Benoue of the Ministry of Planning. The GTZ halted all support and funding on June 30, 1989. The site is located 3.6 kilometers from the Benoue River. The sorghum/millet program has used this site for both rainy season and dry season trials. The director of the station indicated that it would take a minimum of 25 million CFA annually to operate the station. The station is well equipped, but too expensive for IRA in its current financial circumstances. It would make more financial sense to place any irrigated work on an existing Semry perimeter or on the Chinese-assisted perimeter near Lagdo.

There are two major facilities problems in the North. One is the selection of Mouda as the main experimental farm for Maroua Center, as discussed above. The economic crisis has delayed the start of construction of the provincial hospital, so the Guiring station can be used in the interim. However, researchers have to hedge their bets about when construction will start. Development of Mouda will be a very expensive process in terms of capital cost, high transport costs from the 60 km round trip to Maroua, and from decreased efficiency in mechanized field operations on experimental fields which will probably have to be scattered over the 600 hectare parcel. The second is a potential problem of greatly increased recurrent costs due to the expressed desire of the Maroua Center Director to increase the number of substations to cover the Mandara mountain area and the lowland plains, two zones not currently covered by IRA substations, and the impact that Projet Garoua (supported by the CCCE) is likely to have on the reopening of substations closed two years ago because of shortfalls in operating funds. Both issues require concerted donor attention and agreement to work together to help IRA establish its facilities development priorities.

Data and Information Management

The individual handling of research data and its analysis is well done. Each of the expatriates and counterparts and the substation managers had a clear idea of how trial and survey data should be collected and communicated. Field books with trial plot layouts are kept at the relevant stations and substations. Many researchers use field data sheets which are regularly transcribed onto master data sheets by the principal investigator.

TLU survey data collection and analysis capacity is impressive, particularly at Bambui, where a truly overwhelming data flow was well handled. Two specific instances of difficulty were found. One was in the mini-kit trials, where response rates were low when TLUs depended solely on extension agent follow-up for data collection. The second was in data collection in on-farm trials in the North where some observations were not carried out. These problems may reflect over-extension of the on-farm trial (See Annex H), which could be corrected by carefully selecting villages in different agroecological zones and reducing treatment replications in farmer implemented trials.

Computer and printer requirements for the NCRE project seem to have been underestimated. This issue was raised in the Phase I evaluation of 1987. It has been partially resolved since then. But each of the centers of NCRE should have two computers and two printers for program use, because demand for their use is high; computer literacy for counterpart staff requires both training time and time for analysis, and back-up systems are needed when computer servicing times are long. The early years of the project saw many of the computer needs of the project being supported by individual researchers. Maroua until recently had only one computer which was used by all researchers, as well as by the center. At a minimum, the hard disk on this computer needs to be replaced. The Bambui programs have been supported by a single project computer and the computers owned by the technical assistance. Dschang has a single computer. Ekona has two computers, one of which is occupied primarily by the rubber crops program. Laptop computers are under order according to NCRE project management, but their procurement status is unclear. These should have been purchased and delivered in the start-up phase of the project.

NCRE has benefitted from the strength of the IRA biometrics unit which maintains software, does programming and statistical analysis, and can do standard software troubleshooting. There is the technical capability within IRA to maintain NCRE-purchased hardware and software after the technical assistance is phased out.

Documentation

NCRE researchers report annually on the results of their experimental programs and devote considerable time and effort to the development of workplans and protocols. These are well documented. Special reports on survey results also are produced regularly. Two sub-programs, TLU Ekona and Cereals Agronomy in Garoua, have made special efforts in preparing training materials and technical bulletins. At

TLU Ekona this activity has grown out of its training programs and recognition of major problems in the area of pesticide use. In Garoua, the strong demand from SODECOTON and access to SODECOTON's training division have led to the preparation of materials intended for extension agent training. The TLU annex (Annex H) discusses the need for greater attention to extension publication.

Bibliographic support of all research programs is highly individualized. When asked how they did bibliographic searches, researchers had diverse responses. Some sent bibliographic search requests to IITA, others preferred to wait until they made a trip to IITA to do searches, and others had friends or colleagues at IITA who would do searches for them. IITA has begun to send title pages of major journals to NCRE to enable researchers to scan for titles important to their program. Cameroonian researchers indicated that they tried to carry their bibliographic and reference materials back with them after training. None mentioned station archives or university libraries which they felt would be of use to them. During the team's visit to UCD, the Florida team indicated that they had a telephone link to scientific databases which could be used cooperatively. This was a fact not known to researchers.

The evaluation team was especially struck by the lack of station archives and by the lack of recent additions of annual reports and station research results to the documentation centers at each Center. While IRA budget cuts have eliminated subscriptions to scientific journals, the stations should be building up the record of the experimental programs carried out in their zones of responsibility. Where older journals and archives were available, not much attention appears to have been paid to them. Only two of the sub-program presentations made explicit use of earlier research activities as elements which oriented or informed their trial development. This is perplexing, because some of the research avenues being pursued today by NCRE were explored in the past particularly in regards to soils in the north, land management on the Bamileke plateau, "ecobuage" or "Ankara" subsurface residue burning, and rice and other crops in the Mbo and Ndop plains.

Publication in peer-reviewed journals does not seem to be a priority for IITA or for IRA. Despite the allocation of funds for publication, there have been few journal articles produced by the project. Only one example was found. Two other articles were in preparation. In terms of development of institutional capability, this is a weak point that should be strengthened by requiring expatriates to work with their counterparts to develop papers for submission to peer-reviewed journals, starting with the one published jointly by IRA/IRZ, the *Bioscience Review (Revue Science et Technique)*.

RESEARCH COORDINATION AMONG COMMODITY PROGRAMS

The Root and Tuber Crops Project. The Ekona TLU has been an active collaborator with the ROTREP project and with the British Gatsby Foundation's work in the extension of root crop planting materials. The TLU has made substantial collections of cocoyam and yam materials for ROTREP, performs on-farm trials of

cassava clones and cassava-maize intercropping, and collaborates on surveys into the cocoyam root rot problem. As most of the ROTREP project activities are upstream research with a heavy cytogenetics focus, the current level of research coordination between ROTREP and NCRE is adequate.

Bean/Cowpea CRSP. The expatriate TA for this project is an entomologist working on a host-country contract with IRA. He receives support from NCRE for intercropping trials and from the Bean/Cowpea CRSP for research in controlling postharvest storage losses. As described in Annex I, NCRE resources are not being used entirely for the intercropping program, but are spread among both Bean/Cowpea CRSP activities and groundnut research. There does not appear to be sufficient accountability in this program to NCRE in research design and the use of NCRE resources. The expatriate TA also serves as national grain legume program coordinator, a role which is difficult to fulfill as IRA operating funds for travel are very limited. Before there can be more effective interaction between NCRE and the CRSP, the bean/cowpea activities and their management needs to be improved. As indicated in the financial annex (Annex F) an audit is needed to identify the magnitude of the management problems and recommend solutions. Greater management control might be achieved by incorporating the bean/cowpea program within an NCRE project with a broadened research mandate.

CIRAD Assistance to Grain Legumes. Two French researchers work out of Dschang on bean crops. One works on varietal testing and invests substantial time in maintaining bean collections. The second is a specialist in mycorrhizza. There is little evidence of cooperation between NCRE and the grain legume projects. NCRE is housing a U.S. graduate student working on mycorrhizza, but there is little interaction on this topic as well. Given the importance of beans to the Bamileke plateau and in maize-bean double cropping, greater cooperation should be encouraged.

Projet Garoua, the CCCE-assisted project which appears to have taken over the previous World Bank-supported Projet Centre Nord, is most active in cotton research, but is also working in animal traction, animal production and health, fruits and agroforestry. Besides cotton breeding and agronomy staff, there is also a recently arrived weed scientist and an entomologist. Given the importance of SODECOTON to the north and the complexities of the cotton rotation, the existing technical cooperation between NCRE and Projet Garoua researchers needs to be improved. Managerial coordination at the donor level is needed to ensure that a compatible strategy is developed and followed to avoid excessive increases in recurrent costs of IRA from reopening and expansion of substations. The CIRAD/Yaounde representative indicated that expansion of geographical coverage was not a component of the project, this information does not appear to have altered the Marou center chief's objective to open new substations.

OVERALL RESEARCH MANAGEMENT

The 1987 evaluation of the first phase of NCRE gave the project high marks for its research management. It commented in particular on the initiation of the annual

research conference as a large step forward in communicating research results and providing a forum for review of research plans. At the same time the 1987 evaluation recommended that consideration be given to alternating the national conference with regional conferences, where greater attention could be paid to establishing a research dynamic among IRA researchers and client groups. The regional conference recommendation has been implemented as a part of the research review and work plan development process by NCRE. It should be noted that a process of annual review in northern Cameroon has been in place for some time, because of the importance of SODECOTON in the adaptation and integration of new technology into the cotton rotation in that portion of the country. The institutionalization of the annual regional and biennial national research conferences within IRA is a significant project achievement.

The issue of IRA research management capacity is discussed as a major issue in 1987 evaluation. IRA research management was characterized as good but thin. The same commentary applies today. Many NCRE project decisions are held up when the IRA Director General, who is also NCRE national coordinator, is traveling. Another example is that the IRA Action Plan draft was prepared by a committee of six people, three of whom came from the NCRE project. While the first phase evaluation recommended that more staff be assigned to the Director's office, this recommendation would have required reallocation of senior people from leadership posts at major centers and stations.

The need for a staffing and human resource development plan has become a clearly more important issue than it was in 1987. The reduced financial condition of the institute requires careful examination and prioritization of staffing needs that mesh with the requirements for scientists and technicians to perform research on key problems within the limits of total available funding.

The priority setting process of the agronomic programs of NCRE is not yet adequate to the challenges presented by the economic crisis. NCRE and IRA staff are still operating under the original project assumptions that key inputs and credit would be available in increasing amounts over the life of the project, and that the existing marketing systems would create a large effective demand for production technology. Obviously, inputs and credit are not as available as they were a few years ago.

Still, the agronomic programs of NCRE tend to continue research on liming and green manure crops, despite the knowledge that it would cost nearly $900 a hectare to lime the acid soils at some sites and that green manure crops have a high energy requirement (mechanical or human) for incorporation before they are effective. The agronomy program is also engaged in multiple year trials of different sources of phosphate. Many of these trials have been carried out in similar agroecological zones in Africa for years (IRAT-Togo, ISRA-Senegal, SAFGRAD-Burkina Faso, the Joint OAU/UN/SAFGRAD trials throughout West Africa, Zaria/Samaru-Nigeria). The results have been the same as those being obtained in Cameroon, that rock phosphate is less soluble than partially acidulated rock phosphate, which in turn is less soluble than high analysis phosphate fertilizers. Only in those countries with high quality phosphate rock and high freight costs from the ocean to the interior (Mali) has rock

phosphate been making inroads into the national phosphate market. Even in Togo, the source of much of the material distributed for IFDC trials, there has been little expansion of the rock phosphate marketplace. These trials are less than efficient uses for NCRE resources, because no economic analysis is being performed on these trials; costs of the alternate phosphate sources are quite high putting them out of the reach of most farmers; and, the basic soil test capacity to track soil phosphorus levels is not available on a timely basis. Green manure trials are of interest where production systems are mechanized, labor is not a constraint, or where land has such a high premium that farming has become more intensive gardening than field crop production (Rwanda highlands). Such techniques have application in Cameroon (rice perimeters, some SODECOTON areas, larger commercial farms) but not for the large mass of producers. Even the larger projects and farmers are not likely to adopt this practice unless there is a clear positive marginal return on an annual basis.

Part of the problem in setting research priorities is that the agronomic staff of NCRE do not appear to internalize the information received from the TLUs about production and post-harvest practices and constraints. The agronomic trials have tended to oversimplify the intercropping pattern to meet their needs for clean experiments, rather than develop or adapt their experimental methods to work with the complexities of multiple-cropped fields. Even when mimicking local production practices, the Ankara (underground burning of vegetation) systems for example, agronomists have tended to do things, such as reversing the spatial arrangements of intercrops, to fit their needs, despite the comments by farmers that such changes make their field operations more time consuming. In other cases, the on-station field trials neglect to track some of the most critical variables in the local production systems -- labor requirements and weed densities, for example.

A notable exception in this regard is the cereals agronomy program in the North. SODECOTON has such economic and institutional power that it controls the conduct of most field experimentation done by research. The benefits of this control is that a client which is intimately involved in delivering inputs and production credit and insists on high net benefits to its farmers, ensures that a large portion of the agronomic research is directed to answering near-term production problems. Hence, the agronomic program focuses on reducing tillage intensity, improved seed treatments, postharvest treatment of cowpeas, Striga control, crop varieties and fertilization practices are shaped to fit what SODECOTON believes will meet the needs of a specific group of farmers. Also, the large plot size (0.25 ha) imposed by SODECOTON upon on-farm trials provides the opportunity for much better economic and operational evaluation of technologies identified on station than small on-farm plots.

The second part of the problem is with the Project Paper (PP) design itself, which gave a technical assistance staffing pattern and a general orientation that was squarely focussed on production technology to be developed from field plot trials. Much of the work of TLUs has indicated the importance of post-harvest handling, processing, and marketing constraints to expanded use, and, therefore, increased effective demand, for crop production. There is a void at the station level in non-field plot research into storage, food technology, and marketing which is needed to prioritize research problems. These areas are structural weaknesses within IRA itself

but NCRE should have been able to read the signals more clearly earlier in the project implementation process and adjust both long-term staffing and short-term TA accordingly. The general need for greater economics input was noted in the 1987 evaluation.

Due to work loads which are heavy with trials, there has also been a tendency towards compartmentalization of functions within the IITA technical assistance team itself. For example, the IITA team has four soil scientists working as agronomists. Despite their backgrounds, the four do not consult regularly on soils problems. The work plan of one, the lowlands maize agronomist, is the only one which specifically allocates time to work on soils problems outside of his zone of assignment. Job descriptions have also introduced rigidity into the way the TA team operates. In the North there are major weed management problems, one of which is *Striga*. The IITA team has a weed scientist who has been assigned as extension agronomist to the Nkolbisson TLU. It has proven difficult to free the time of this specialist to consult with his colleagues in the north on weed management, if only to define the terms of reference for short-term assistance in this area.

An example of compartmentalization which extends to the IRA staff is the reliance on specialized inputs for such things as disease and insect counts in field trials. In at least three locations, it seemed that observations of plant diseases were dependent on the presence of a plant pathologist. The role of the plant pathologists in IRA really should be to train researchers in identification and observational methods for the major diseases, to identify diseases which are difficult to distinguish from field symptoms, and to assist in the interpretation of results.

A similar statement can be made about simple partial budget analysis. It is no longer unusual to expect agronomists to perform simple partial budget analysis that treats the realistic chain of impacts of a new technology on input costs and added labor and associated costs. Economists can and should provide guidance, basic data, and assist where there are especially difficult problems, but researchers should be trained to do the basic analyses themselves, rather than requiring them to be done by an economist. The agricultural economists on the TA team are quite capable of teaching their colleagues on the IITA team and IRA team members how to perform these analyses.

The evaluation team believes that the difficulties inherent in identifying the agronomic research program of NCRE and linking TLU and agronomy research agenda could be relieved to a great extent by two major actions. First, that agronomy and extension agronomy positions should be cut by four, with the remaining agronomists given responsibility for both on-station and on-farm trial work. This will force targeting of the agronomy trial program and ensure better coordination between TLU and the on-station program. The number of trials will be reduced, but this will be consistent with the recommendations of other team members to focus more on representative sites, rather than trying to maximize geographical coverage.

Secondly, it would be useful to have IRA and NCRE establish a medium term strategic plan (1990-1995) which specifically addresses the challenges imposed upon Cameroonian agriculture by the economic crisis and ranks technology development

priorities accordingly. Issues of agroecological and geographical zones of production concentration; potential for increasing marketed product; reducing cost of production, storage, and processing; as well as past research experience and program strengths, need to be taken into account. An external panel of specialists will be needed for this exercise to provide a scientific sounding board for the proposed priorities and research directions and to avoid the inbred analysis that such plans tend to have when done wholely in-house. Such a plan should be developed by the end of 1989 with external review before the annual work plan is finalized for 1990/1991.

THE CURRENT AND FUTURE RESEARCH MANDATE OF NCRE

Current Mandate

The current research mandate concentrates on production-enhancing technologies for maize, rice, sorghum, and to a lesser extent millet, with treatment of other crops where they are important in local cropping systems. Related crops where significant amounts of work have been done are cassava, groundnuts, cocoyams, cowpeas, and common beans. The PP further mandated a concentration on production technologies, with the qualifier that these be adapted primarily to the agroecological and socioeconomic conditions of smallholders. The intended geographic coverage of the project was national with five Centers/Stations receiving concentrated investment.

Future Mandate

With Cameroon approaching cereal self-sufficiency, and with declining public budgets available to support research, the next phase of the project should have a mandate which responds to the changing economic conditions without threatening the programmatic capacity of IRA to maintain the supply of breeder seed of improved crop varieties and incorporate new sources of disease and pest tolerance as pathogen complexes shift over time. The team would recommend the following changes in mandate:

- Crop coverage: cereals and grain legumes, with rice and sorghum in maintenance programs; emphasis on maize and grain legume crops as intercrops and rotational crops;
- Incorporation of soils resource management services and soils capacity building within IRA;
- Economic analysis for overall research priority setting and for investigations on commodity systems and market analysis in specific zones;
- Postharvest storage, and processing technologies adaptable to smallholder, larger farming operations, middlemen, and processors;

- Production technology focus shift from yield-increasing technology to yield-stabilizing technology and cost-reduction strategies;

- Priority agroecological and production zone concentration of effort opposed to the current full national coverage objective;

- Incorporation of the mandate to balance trial-plot-based research with other research methodologies where needed (operations research on irrigation perimeters, technology research in IRA or through collaborative links to other Cameroonian institutions);

- Clear and careful identification of long-term research projects and sites for alley cropping and agroforestry as a special research and budget category; and

- Balance between station trial plot based research and operations research and technology research (facilities and staff requirements differ).

It goes beyond the ability and time limitations of this team to map out how to fully operationalize these new directions and operating principles for NCRE. The evaluation report's main body, soils, plant breeding and economic analyses present some options. However, shifting gears, reviewing programs, and sorting out whether it is institutionally feasible to adopt some of these new directions will require additional study by USAID, NCRE/IITA staff, and IRA as a whole. The team has recommended that a strategic five-year plan for NCRE be the basis for beginning to reorient individual programs and research activities.

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