PD-ABA-843

65928

ROOT AND TUBER FOOD CROPS RESEARCH IN CAMEROON

PROJECT NUMBER: 631 0058

EVALUATION REPORT
July 26 through August 19, 1989

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September 26, 1989

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Washington, DC 20523

Dear Sirs:

Attached please find the Final Evaluation Report of the Mid-Term External Evaluation of the Cameroon Root and Tuber Root Crops Research Project. The Evaluation began with an orientation visit to USAID, Washington, on July 26, 1989, followed by a visit to the project office at the University of Maryland Eastern Shore on July 27, 1989, and then on to the project site in Cameroon.

We very much appreciate the opportunity to participate in this worthwhile assignment, and we hope that, based on the Scope of Work presented our report is in compliance with the Contractor's, GRC and USAID requirements.

If additional information is needed, please feel free to contact us.

Sincerely,

Vernon Johnson

Dr. Vernon Johnson
Evaluation Team Leader

Walter Hill

Dr. Walter Hill
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Dr. Francoise Tchala
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Copy: Mr. Jay Johnson, USAID
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cjc
Attachment

EXECUTIVE SUMMARY

A. INTRODUCTION

An evaluation of the project 631-0058, Root and Tuber Food Crop Research, was conducted between July 26 - August 19,1989. The Project, under a cooperative agreement contract with three collaborating 1890 universities was activated at the Cameroon's Ekona agricultural research station in February, 1987. It has three primary objectives as follows: to develop an economically feasible rapid seed-stock multiplication technology (relying heavily on tissue culture method) for cassava, cocoyams, and yam; develop a cocoyam variety that is resistant to the devastating disease, root rot; and to stimulate interest in post harvest problems through a diagnostic study that was designed to examine storage, processing possibilities, and utilization of root and tuber crops.

The evaluation comes at the mid-point of the five years allotted the first phase of the project. Its primary purposes were to review and assess the management and technical aspects of the project, determine the extent of progress toward its stated objectives, then based on the findings, make recommendations including mid-course corrections that can benefit the project. Such recommendations can be used by the Chief-of-Party, the contracting universities, USAID, and host country officials.

The Evaluation Team consisted of three persons, an agronomist, an agricultural economist (team leader), and a Cameroonian rural sociologist (see briefs on team members Appendix E). All members of the team have previously worked professionally in Africa, and the rural sociologist has intimate knowledge of the country and its institutions.

B. METHODOLOGY

Regarding method, the team relied on oral reports, interviews involving a number of persons who possess particular knowledge about root and tuber crops, or others who had special interest in the evaluation (see: persons contacted by evaluators, Appendix C). In addition a large volume of secondary reports and government documents were read, opinions of small farmers were sought, and finally, site visits and rapid appraisals were made by the evaluators.

In accordance with the scope of work (SOW) and the project's logical framework, the Evaluation Team examined project management and administration, technical and scientific elements of the project, and institution building through training and linkages with related institutions. Although economic issues were not listed for examination in the SOW, their significance to present and future outcomes of technical activities are evident. For this reason, an economic overview was added to the evaluation.

C. FINDINGS AND CONCLUSIONS

1. Project Administration and Management

Under this heading, it was found that project management at UMES (the prime university grantee) was efficient and in every way should be accorded a rating of excellent. Management of the project in the field also was exemplary, but was graded down a point in that several objectives were mis-timed and long-term training and economic analyses that were contemplated have lagged, albeit for reasons that could not have been foreseen. Administrative oversight, on the other hand is excellent. It is stated by USAID officers and others that the efficiency with which the procurement, inventorying, record keeping, financial accountability, submission of reports, and overall office management could serve as a model for A.I.D. work under similar cooperative agreements. The team found no problem with accountability or compliance. The one observation that could grow into a problem is lack of a replacement for the administrative assistant to the point that she finds it difficult to take leave.

2. Technical and Scientific Evaluation

Considerable progress has been made toward achieving the scientific and technical objectives of the project. ROTREP should be congratulated for the speed at which it has progressed especially in construction, and laboratory installation. On the other hand, several objectives proved to be more complicated than first assumed.

For example, one project objective was to develop a root rot resistant cocoyam cultivar for different agro-ecological zones. This rested on the underlying assumption that locally tested improved cocoyam germplasm would be available in the national collection that was resistant to root rot; that such cultivars could be hybridized and progeny tested for resistance to root rot

and evaluated in agronomic trials. However, it was verified that the non-edible yellow type cocoyam (polyploid), which is resistant to the disease has a different chromosome number than the non-resistant, edible white type (diploid). Thus the strategy for this scientific activity had to be changed throwing this element of the project off its time table.

Likewise it was assumed that on-farm testing of cassava, yam and cocoyam seed-stock derived from tissue culture technology could be tested on farmer's fields within the life of the project. After the project was begun, considerably more up-front research than anticipated was needed to move forward efficiently toward rapid multiplication of the seed-stock. These examples indicate some of the pitfalls and unforeseen problems common to scientific research in Africa. However, the ROTREP team is to be congratulated for the innovative way that they have met these difficulties. Some of their findings e.g., use of secondary buds of cocoyams and use of yam node cuttings for tissue culture propagation provide pioneering information to agricultural science as a whole. At this stage, adequate tissue culture derived plantlets of cassava, yam and cocoyams are ready for on-station trials.

A diagnostic survey to assess storage, processing, and utilization possibilities for root and tuber crops was conducted in 1987 for all three crops under the project. The report covered 724 households in the four major root crop provinces as well as Douala. However, to proceed further, the food technology laboratory at Njombe would have to be improved, and the partially completed new wing would have to be completed. Action is still pending.

The scientists at Ekona working under the project (Americans and Cameroonians) appear to be efficient and, for the most part they function well as a team. The senior U.S. plant breeder/tissue culturist provides excellent leadership in maximizing the contribution of each team member.

3. ROTREP and Institutional Development

The Evaluation Team notes that installation of the tissue culture laboratory and construction of greenhouses in record time gives the project a definite institutional anchor at the Ekona research station. The scientific work that can be accomplished will increase the credibility of the entire IRA research system.

As for institution building through training, ROTREP's achievements for on-the-job training is excellent, that for

short-term training is satisfactory, while long-term training is below satisfactory at this time. The delay in the latter training results from unreliable assumptions about the prospect for finding counterparts and otherwise finding trainees to fill other slots. Also with regard to training, the Evaluation Team is of the opinion that training as now proposed is weighted too heavily toward M.S. level as compared with Ph.D level training. Although funds are said to be the limiting factor, we suggest that quality of training be the main objective even at the expense of numbers.

ROTREP has already established informal and some formal linkages with surrounding institutions such as IITA, GATSBY, NCRE, IRA-CIP, UIC and UCD. These linkages should be strengthened especially with organs such as TLU and UCD.

4. Economic Oversight

The Evaluation Team found that ROTREP is being implemented at a time of severe economic crisis in the country and thus cannot totally escape its impact. A continuing review of recurrent cost planning and restraint against anything that will put more financial demands on government is suggested.

Beyond this handicap, however, the team believes that ROTREP warrants support to the fullest extent that is possible. The economic importance of crops being researched is uncontested. A small, highly qualified team is in place, the project is receiving its full complement of support from GRC despite the economic crisis, and when matched against historic criteria for successful agricultural research in Africa, ROTREP rates well.

The Evaluation Team suggests, nonetheless that the economic analyses that are being planned under the project, while needed by the station, are beyond the resources available under the project to the extent that success would be doubtful. This program should be reduced in scope. One approach toward economic analyses of root crops is for ROTREP, TLUs, the Department of Agricultural Economics at University Center Dschang, and the Department of Statistics and Surveys of the Ministry of Agriculture (MOA) to meet and decide on a mutually beneficial program. Implementation and the sharing of work also could be decided.

Finally, as in most African countries, ROTREP, as now planned, places most but fortunately not all its emphasis on the supply side - more improved plantlets to increase productivity. If phase II of this project is approved as the team recommends, we strongly suggest that food technology, processing,

utilization, market expansion and other measures to expand demand for the products be given ample attention. Without these measures, little growth will occur.

D. RECOMMENDATIONS

1. Under Present Project Phase

   a. The Evaluation Team recommends that intensive research on cocoyams be continued. They are a preferred root crop throughout the West Coast of Africa and beyond and farmers in Cameroon continue to grow them in spite of losses from root rot disease. ROTREP is on the right research track, but personnel is thin. The team recommends therefore that an experienced plant pathologist, Ph.D level, be added to the team for at least one year to ensure that the effort to control root rot disease on cocoyam is maintained and accelerated within the time-frame of the project.

   b. The economic analysis program as proposed for the project should be pared down to a level more compatible with human and monetary resources that are available. But even if done, the time of the present COP/agricultural economist is consumed almost totally in oversight and administrative duties. The team suggests therefore, that the COP be assisted for one year to tailor an economic activity that is within the scope of available resources; that University Dschang be approached to second an agricultural economist to the project for this purpose; or project resources permitting, a U.S. graduate student in quest of dissertation material be recruited to establish a program that could then be overseen by the COP and his local assistants.

   c. As means of reducing costs while widening the base of agricultural research on root and tuber crops in Cameroon, it is essential that ROTREP strengthen its linkages still further with NCRE-TLU, UCD and with IITA if, as assumed, that International Center establishes a permanent station in Cameroon.

   d. The management staff and the management posture of ROTREP should remain in place. It might be studied as a model for other projects under cooperative agreements.

e. The plan for long term training under the present phase of the project should be accelerated and revised. An appeal should be made to GRC to speed up its approval process for candidates. Moreover, for research purposes most candidates should be financed through Ph.D rather than M.Sc. degrees. If training funds are the limitation as indicated, quality and future project sustainability should override even at the expense of numbers trained.

f. Because of the present economic crisis GRC is having to make painful economic adjustments. It is therefore suggested that ROTREP refrain from any management decisions that imply increased commitments on the part of the host government.

g. Based on historical evidence regarding characteristics of viable and sustainable agricultural research endeavors in Africa; achievements to date, the economic importance of root crops, and active GRC support, despite an economic crisis, ROTREP warrants continuing strong support from A.I.D. The Evaluation Team strongly recommends therefore that consideration be given to extending the life of project to 1996. (Phase II) in conformance with GRC's five-year Plan.

2. Future Considerations

a. During phase II, if granted, it is suggested that ROTREP continue and perfect its scientific trials and testing of root crop materials, see that on-farm testing is continued and that the distribution of plantlets moves forward at an acceptable pace. Action should continue to interest local investors in the distribution and production of low cost tissue culture seed-stock. Assuming that the food technology laboratory is operational at Njombe, transformation and utilization of root crops should move to a higher priority in the interest of increased demand.

b. In addition to the expansion of demand on the domestic market and attention to food technology in this regard, the tissue culture lab could, as feasible, include other key crops such as plantains, but meanwhile should (perhaps for a fee) make its services available to other donors, CIP, IITA and especially to private companies such as Del Monte which would be interested in better varieties of bananas.

c. Also if the project is extended to phase II, and if technology and increased production can ensure a reliable supply of better quality products, teams with the objective of market promotion should be sent to neighboring African countries to fill gaps that are said to exist in these markets, and to Europe in attempts to increase demand both for human and livestock food. Persons with marketing and business experience should head such investigations.

d. Finally, a general recommendation refers to the planning of work for Evaluation Teams and others that will be coming to Cameroon. Our work was too crowded up-front. We recommend that after proper protocols are met, team activities be planned in a series of 3 days of information gathering followed by 1 day reflection/writing. This would avoid the crush at the end of the study, and make for an improved product.

PROJECT IDENTIFICATION DATA

1. COUNTRY: CAMEROON

2. PROJECT TITLE: ROOT AND TUBER FOOD CROPS RESEARCH IN CAMEROON

3. PROJECT NUMBER: 631-0058

4. PROJECT DATES:
   a. Cooperative Agreement: August 29, 1986
   b. Final Obligation Date:
   c. Grant Agreement Amendment 1:
   d. Grant Agreement Amendment 2:
   e. Grant Agreement Amendment 3:
   f. Original Project Assistance Completion Date: August 29, 1991.

5. PROJECT FUNDING ($ MILLIONS):

a.	AID Bilateral Funds:	$5.7
b.	Cameroon Counterpart Fund	$2.1
	TOTAL	$7.8

6. MODE OF IMPLEMENTATION:

AID Bilateral: Cooperative Agreement with University of Maryland Eastern Shore as lead institution with sub-agreements with Alabama A&M and Florida A&M Universities.

Republic of Cameroon Government (GRC): Protocol Agreement between GRC and the three collaborating universities.

7. PROJECT DESIGNERS:

- University of Maryland Eastern Shore (UMES), Alabama A&M (AAMU) and Florida A&M University (FAMU).
- GRC Officials
- Mission Staff

8. OTHER PROTOCOLS:

- Memorandum of Understanding with IITA

9. RESPONSIBLE MISSION OFFICIALS

   a. Mission Director: Jay Johnson, 1986 - Present
   b. Project Officers: William Judy, 1986 - 1987
      Gary Cohen, 1987 - Present

10. Previous Evaluations: None.

a

TABLE OF CONTENTS

	PAGE
THE EXECUTIVE SUMMARY	i
A. Introduction	
B. Methodology	
C. Findings and Conclusions	ii
1. Project Administration and Management	
2. Technical and Scientific Evaluation	
3. ROTREP and Institutional Development	iii
4. Economic Oversight	iv
D. Recommendations	v
1. Under Present Project Phase	vi
2. Future Considerations	
BODY OF THE REPORT	
A. Background	1
B. Economic, Political and Social Context	2
C. Team Composition and Method	
D. Evidence and Findings	3
1. Management and Administration	
a. Project Management	
(1) AID/Washington	
(2) University of Maryland Eastern Shore	4
(3) The Role of USAID	5

b

TABLE OF CONTENTS

	PAGE
(4) The Field Management and and Administration	
(a) Project Emphasis	
(b) Financial Management and Control	6
(5) Looming Management Problems	8
(6) Recommendations	8
2. Technical and Scientific Findings	9
a. Perspective	
b. Research and CNRCIP 1978-1986	
c. Purpose of Objectives of ROTREP	10
d. Evidence and Findings	
e. Limitations of Project Assumptions and Design	11
(1) Objective 1	
(2) Objective 2	
(3) Objective 3	
f. Technical Staff	18
g. Recommendations	20
3. Institutional Development	21
a. Institutional Setting, Mission and Organizational Structure of IRA	22
b. Anticipated Institutional Outcomes of ROTREP	23

TABLE OF CONTENTS

		PAGE
c.	Framework for Institutional Analysis	24
d.	Findings and Recommendations	
	(1) Physical Structures and Equipments	
	(2) Human Resource Development	25
	(a) On-the-Job Training	
	(b) Short-term Training	26
	(c) Long-term Training	28
	(3) Linkages with Other Institutions	31
	(a) Link with the GATSBY Charitable Foundation	
	(b) Link with the National Cereals Research and Extension Project (NCRE)	32
	(c) Link with International Potatoes Center (IRA)	35
	(d) Relations with the Opportunity Industrial -ization (OIC) Buea	
	(e) Link with the Univesity of Dschang	
	(f) Other Linkages To Be Established	39
	(g) Recommendations and Summary	

d

TABLE OF CONTENTS

		PAGE
(4)	Economic Oversight and Implications for Expanded Production	41
	(a) General Information	
	(b) ROTREP and The Economic Crisis	43
	(c) Economic Analysis Under The Project	45
	(d) Comments	47
	(e) Historical/Institutional Tests	49
	(f) Future Projections	51

LIST OF TABLES

		PAGE
Table 1	Technical Status of ROTREP Research on Cocoyam and Root Rot, August 1989	12
Table 2	Technical Status of ROTREP Research on Rapid Multiplication of Cassava, Yam, and Cocoyam August 1989	13
Table 3	Synopsis of ROTREP Existing and Possible Future Linkages With Other Institutions	38
Table 4	Relationship Between Current and Anticipated Action Under ROTREP Project and Needed Action On Food Technology, Utilization Market Expansion and Demand for Root and Tuber Products	57

ACRONYMS

ROTREP	-	Tropical Root and Tuber Food Crop Research
GRC	-	Government of the Republic of Cameroon
CIP	-	International Potato Center, Lima Peru
IITA	-	International Institute for Tropical Agriculture
IRA	-	Institute for Agronomic Research
UMES	-	University of Maryland Eastern Shore
NARS	-	National Agricultural Research System
HA	-	Hectare
CDSS	-	Country Development Strategy Statement
IRAT	-	Institute for Agricultural Research and Technology
CNRCIP	-	Cameroon National Root Crop Improvement Program
IDRC	-	International Development and Research Cooperation (Canada)
AGDC	-	General Agency for Development and Cooperation (Belgium)
UCD	-	University Center, Dschang
OIC	-	Opportunity Industrialization Center
NCRE	-	National Cereals Research and Extension Project
MOU	-	Memorandum of Understanding
ENSA	-	National Advanced School of Agriculture (Cameroon)
ITA	-	Institute of Agricultural Technology (Cameroon)
INADR	-	National Institute of Rural Development
IBRD	-	International Bank for Reconstruction and Development (World Bank)
TLU	-	Testing and Liaison Unit, NCRE

BODY OF THE REPORT

A. BACKGROUND

Roots and tuber crops - cassava, cocoyams, yam, sweet potatoes, irish potatoes - dominate agricultural production and consumption patterns in the southern provinces of Cameroon. In 1986-87 production was on the order of 1,861,000 metric tons, with cassava being about three-fourths of the total (Ministry of Agriculture, Yaounde). It is estimated that at least 40% of the calories produced in the country come from root and tuber crops, 30% from cassava alone. More than half the population of Cameroon live in the area where roots and tubers are the staple foods. As one moves North, cereals (maize and sorghum) are the major food crops but roots and tubers are still important as security crops in that maize is highly vulnerable to drought.

The importance of root and tuber crops in Cameroon was a critical factor which attracted the collaborating universities to select that country for its research work. Another important reason for selecting Cameroon was that A.I./D, in its Plan for Supporting Agricultural Research and Faculties of Agriculture in Africa (A.I.D 1985), assumes that African countries, based on objective criteria, are at different stages of research development, and Cameroon was selected as an advanced country with the capacity to produce and share research technology.

For the project itself, the collaborating 1890 universities - Alabama A&M, Florida A&M, and the University of Maryland Eastern Shore, submitted their first proposal to A.I.D in late 1983. This, in turn led to a travel and planning grant whereby representatives from the universities could visit West and Central Africa. Based on the information gathered, the proposal was to be refocused and submitted in revised form. As a result, the scope of the proposal was narrowed to a single country and a single category of crops. The project was then designed in its present form and given the title Root and Tuber Food Crops Research Project (ROTREP) (See log-frame (Appendix B.)

The project began work at the Ekona Research Station in February 1987. It has three primary objectives. They are to develop and put to use an economically feasible rapid seed-stock multiplication technology for cassava, cocoyams, and yam; develop a cocoyam variety resistent to the root rot disease and initiate a diagnostic study on the storage, processing and expanded utilization of root and tuber crops.

The project evaluators commenced their assignment on July 26, 1989 in Washington, proceeded to the University of Maryland - Eastern Shore, then spent three weeks in Cameroon. The evaluation comes at the mid-point of the 5 years allotted the first phase of the project. Its primary purposes are to review the management and technical aspects of the project, determine the extent of progress toward the stated objectives, then based on the findings make recommendations including mid-course corrections that will facilitate progress. Results of the evaluation can be used by the contractor, USAID and the host country.

B. Economic, Political and Social Context

The tremendous economic importance of root and tuber crops in Cameroon has been referred to above. A more general discussion of economic relevance is discussed in another section of the evaluation. It suffices to say here that the economic crisis now being felt in the country will definitely affect economic activity at project levels. Although roots and tubers are often perceived as subsistent crops, they are found in every local market in the country, and they move as unrecorded trade to neighboring countries. The farmer makes no distinction between money received for coffee to be exported and yams sold on the local market. Thus market expansion and producer prices are central to the ultimate success of investment in the project.

Politically, Cameroon has been one of the most stable countries in Africa. The Evaluation Team has discerned no constraints to the project that are politically related.

The production, conversion to various forms (19 for cassava alone), varying cooking methods, sale, and daily consumption of root and tuber crops take on a cultural connotation. In general a high proportion of yams are marketed and thus their production is tended by men in Cameroon because, it is said, that men are expected to provide cash for the family. This idea loses its validity, however, in that women who produce the cassava and cocoyams sell far more frequently (though in smaller lots), and on an annual basis usually derive more net income than men. Women as well as men engage in scientific root crop work. The next person for professional technical training in the U.S. will be a woman.

C. Team Composition and Method

The Evaluation Team consisted of three persons, an agronomist, an agricultural economist (team leader), and a Cameroonian rural sociologist. All team members have worked

professionally in Africa previously and the rural sociologist has intimate knowledge of the country and its institutions.

As for method, the team relied on oral reports, interviews involving a number of people who possess particular knowledge about root and tuber research, or others who have special interest in the outcome of the evaluation (see persons contacted, Appendix C). In addition, a large volume of secondary reports and government documents were read, opinions of farmers were sought, and finally site visits and rapid appraisals were made by the evaluators.

We begin our valuative analysis on roots and tuber research in the following order: (1) management and project administration, (2) technical and scientific coverage, (3) institutional and linkage implications, and finally some points on economic oversight.

D. Evidence and Findings

1. Management and Administration

This section of the report is to determine how well supporters of the project have performed in the areas of management and administration. In the project's logical framework, for example, certain objectives are set out. How far has the project gone in meeting these objectives? The Scope of work raised questions regarding management capabilities, commitment, and the quality of project administration beginning with the home campus of UMES, then the field office, and the extent of management integration with the Cameroon's Institute of Agricultural Research (IRA).

a. PROJECT MANAGEMENT

(1) A.I.D./Washington

The team began its evaluation of ROTREP in Washington on July 26, 1989. Broad oversight of the project is handled by the Africa Bureau's West and Central Africa office, and technical oversight is handled by the agricultural division of the Technical Resources office (TR). As noted elsewhere, ROTREP functions under a cooperative agreement. This shifts most of the management load to the grantee. However, the team found that A.I.D. officers retained adequate records and were knowledgeable about the project and Cameroon's agriculture in general. They

requested that the evaluation include special situations which are of interest to the project and to A.I.D.'s overall Agricultural Research Plan for Africa. The team left with a definite impression that adequate oversight and guidance from Washington are being maintained.

(2) University of Maryland Eastern Shore (UMES)

Management of the project intensifies at the University of Maryland, Eastern Shore (UMES). This university has prime responsibility among the three 1890 institutions that are associated with the project. The project manager up-dated the team on the various facets of the project from a support perspective. The team then held discussions with the School of Agricultural Sciences' Chief Accountant and an administrative staff person who have responsibility for maintaining up-to-date records and reports, and for coordinating common accounting procedures with the field. UMES uses an accrual accounting system by which expenditures are reported quarterly. To insure mutual understanding within the project, the person in Cameroon who is directly responsible for financial and administrative project matters visited UMES as a short-term trainee where procedures of mutual interest were agreed upon. Accountability is in strict compliance with State of Maryland and A.I.D. regulations.

The team examined the process of project procurement beginning with an itemized order of project equipment from the field. This order is then put in requisition form by the accountant, approved by the project manager and passed to the Procurement Officer where orders are cut or, depending on the amount to be spent, bids are let in accordance with regulations. The procurement officer reiterated that he operates strictly by the book as laid out by the State of Maryland. When orders are filled, a designated shipper packages and handles the supplies as instructed and ships them to the Cameroon. Except for one delay when a shipper went out of business, this system has worked smoothly.

The team met with the Vice President for administration and with the University President, and Vice President for Academic Affairs. We found them to be fully knowledgeable and supportive of the project.

Based on observations during this one-day visit, the Evaluation Team concluded that an effective and efficient project support system has been established at UMES.

(3) The Role of USAID

Again because ROTREP is under a cooperative agreement, USAID is relieved of most administrative/financial project functions as well as intensive technical oversight. USAID signs off on vouchers. It receives and comments on workplans, annual reports, and Project Implementation Reports (PIRs). The Mission also transmits current agency policy to contract personnel, makes project site visits and comments on management and technical matters.

One advantage of a cooperative agreement is that the contractor functions within a familiar set of working rules and procedures. His work therefore is not impeded unduly by A.I.D. requirements. Another advantage is that A.I.D. is free to use its management talent elsewhere. An obvious disadvantage is that given the degrees of freedom implied in cooperative agreements project focus might be sacrificed. However, the team believes that the arrangement is working well with regard to ROTREP.

(4) Field Management and Administration

Project management and administration in the field office is two-pronged. One prong has to do with technical problems of start-up, oversight of technical performance, and guidance of the project toward its stated objectives. Or, as might be the case, the objectives may require alteration in light of new experience. The second prong covers financial and administrative control of the work program.

(a) Project Emphasis: The goal, purposes, outputs and inputs as they appear in the log-frame have been referred to. They are shown as Appendix B. The Scope of Work requested that the Evaluation Team comment on the grantee's management capability to pursue these objectives; the effectiveness of key management committees that have been established, and to note whether the project has been integrated effectively into the IRA management structure.

The umbrella for the project (and all agricultural research) is the GRC's Institute of Agricultural Research (IRA), but the day-to-day management is in the hands of the grantee's Chief-of-Party (COP). Complementary government contributions to the project are managed under the National Roots and Tuber Program by the Chief of the Center/Station at Ekona where the project work is headquartered.

The Evaluation Team can state without doubt that the management of ROTREP is fully integrated into the IRA system.

The Chief of Center at Ekona (a root crops scientist himself) is kept intimately aware of all project activities by the COP, including travel plans of project scientists, and where necessary written approval is requested before action is taken. IRA provides key personnel for the project, tractor time and costs are shared between the project and the station, and while the A.I.D financed tissue culture laboratory gives priority to project work, it is nonetheless open (time permitting) to associated tissue culture work of the station and even of other donors.

In order to maintain a management focus, the agricultural deans of the three U.S. universities form a Project Advisory Committee, and a counterpart Host Country Management Committee consisting of key research officers and the project Chief-of-Party is established in Cameroon. These two committees when combined form the Project Executive Committee which links the contract staff with IRA staff and A.I.D thus providing policy guidance (administrative, financial, technical) to the project. To date this structure has remained closely coordinated and has functioned smoothly.

The Executive Committee would appear to represent a definite improvement over USAID standard project management. Customarily under A.I.D. financed projects, related contacts stop at the level of the host country's mid-level technical personnel. Top USAID management seldom enters project level discussions except to resolve a crisis.

One indication of Executive Committee strength is that even in this period of economic crisis GRC has maintained its commitment to ROTREP above that of most other projects. The Minister of Higher Education, Computer Services and Scientific Research interceded personally in 1989 to provide a second standby generator for the project, also in 1989 GRC provided 50 million CFA to the project to assist with the construction of the greenhouse complex at Ekona.

(b) Financial Management and Control: In 1987 and again in May, 1989 staff from UMES conducted indepth reviews and provided professional recommendations for

improving the administrative and financial management of the project. The 1987 review made specific recommendation for purchasing and maintaining inventory on all project items purchased in the U.S. or in the Cameroon, how materials and supplies should be issued and other guidelines and procedures. These recommendations are being used at the administrative office and at the project store.

The 1989 study conducted by the Vice President for Administration, UMES, was to review financial administration and reporting, personnel policies and staff needs, use of motor vehicles and finally to review the state of GRC contributions to the project. All financial and administrative procedures were found to be in order, records at the project office and at the project store were being meticulously maintained. However, lags were found in the fulfillment of GRC's financial commitment to the project, but after discussions resolutions were worked out.[1]

The Evaluation Team also visited the project store and spent an afternoon with the assistant in the administrative office who (under the COP) is responsible for accountability and compliance. We found no problems with the system. In fact, it is commonly stated among USAID personnel and others that the UMES management/control system is a model of efficiency. The team would be greatly surprised if subsequent audits reach a different conclusion. Much credit for this goes to the dedication and hard work of the two local office personnel and to the project Chief-of-Party. On such management tasks as project start-up, integration with IRA, installation of equipment, construction, links with the home office at UMES, procurement, and public relations, a grade of <u>excellent</u> is warranted for management. Support of the project's scientists also has been well done though it is seen now that a few technical objectives were, in retrospect, overly optimistic. A grade of <u>good</u> is still warranted. Long-term training and economic analysis have lagged and should now be accelerated. In general, however, the project is on course and should be able to achieve most of its phase I objectives by 1991.

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[1]As reported, to the Evaluation Team, GRC supports 35-40% of the project's operating costs. This conforms with the original agreement. In the main, however, coping with recurrent cost is becoming a growing problem in Cameroon. In general, donors are being requested to assume more responsibility in this regard, and as donors phase out of particular projects, sustainability may be difficult.

5. Looming Management Problems

As stated, until now the project has fared extremely well and in many of its aspects is a model to be copied. The Evaluation Team would be remiss, however, not to mention effects at project level that undoubtedly will derive from the on-going economic crisis in the country.

The GRC has had to take painful economic actions in recent years and undoubtedly will face more ahead. The investment budget for projects such as ROTREP is extremely limited, and at the moment little is left from operation budgets after salaries and benefit costs are met. The Manager of this project, however, is aware and sensitive to this condition as reflected in his own expenditure patterns.

6. Recommendations

a. Project management is under control and indeed some work is moving forward at record speed. There is a slight tendency, however, to overstate the ability to achieve objectives which may later turn out to be unachieveable in the allotted time frame. Care should therefore be taken on this point.

b. No change is recommended in procurement, management of administrative details and financial oversight. It is noted however that the administrative assistant, whose duties are exacting and many, finds it difficult to take vacation or even short-leave. The present secretary should be trained to relieve the administrative assistant and arrangements should in turn be made for short-term secretarial help.

c. Because of the economic crisis sensitivity must continue to ensure that no management decisions are taken which require heavy matching expenditure by GRC.

2. Technical and Scientific Findings

a. Perspective

Agricultural production in Cameroon occurs in five agro-ecological zones including the hilly grasslands (zone I), forests (zone II, III, IV) and savannah and steppe savannah (zone V). For the most part, root and tuber crop production takes place in zones I, II, III and IV; these areas are inhabited by about 75% of the population. Cassava, cocoyam and yam are the major root crops consumed in Cameroon. Estimates vary, but roughly 30 to 80 % of the daily caloric intake of people in the forest zones of Cameroon is derived from root and tuber crops. Because of their importance for food self sufficiency, and low prices of export crops such as coffee and cocoa, the Institute of Agricultural Research (IRA) has given top priority to food crops research. Among the ten commodity programs (six food crops and four export crops), the two commodities with the highest priority for research are cereals and root and tuber crops.

Root and tuber crop research was for many years carried out in the French supported Institute of Agricultural Research and Technology (IRAT). A specific program focus was initiated in 1978 with the development of the Cameroon National Root Crop Improvement Program (CNRCIP). The overall goal of CNRCIP is to increase production of root crops in Cameroon. Specific objectives include the following: development of improved cultural practices usable by limited resource farmers; maximize the yield of improved local varieties with minimum inputs; development of post-harvest technologies which reduce crop losses; improvement of processing methods; and to train a cadre of Cameroonian researchers and technicians to form the nucleus of a continuing root and tuber crops program.

b. Research by CNRCIP 1978-1986

Beginning in 1978 CNRCIP received funds from three main sponsors: GRC, International Development and Research Corporation (IDRC - Canada) and the General Agency for Development and Cooperation (AGDC - Belgium). Technical assistance was provided by the International Institute of Tropical Agriculture (IITA - Nigeria). During 1978-86 research on cocoyam included the following: germplasm collection and characterization, root rot etiology, symptomatology, epidemiology and methods of control; hybrid seed development; agronomic studies including spacing trials, fertilizer trials, shading effects, harvest times; selected agro-ecological effects; and nutritional composition. Considerable research was carried out between 1978 and 1986 on

cassava. A cluster of results followed. A germplasm collection including improved material from IITA was developed and many clones were screened for yield, insect tolerance (mealy bug, green spider mite) and disease resistance (bacterial blight, mosaic virus, anthracnose). Three clones (8017, 8034 and 8061) for zone II and two clones (844 and 228) for zone IV were released to farmers. Improved cultural techniques for farmers with both low and high intensity management systems were also developed. Substitution of 10 to 15% cassava flour in French type bread with consumer acceptability, and a survey that found 19 cassava based products being used in Cameroon were additional results. Between 1978 and 1986 five Dioscorea species were tested for adoption to various agro-ecological zones. Eight cultivars (D. rotunda - four, D. esculenta and D. dumentorum - two, D. cayensis - one, and D. alata - one) were selected and recommended for specific zones. Spacing, time of harvest and fertilizer trials were carried out and a cropping package for yam production in zones II and IV was developed. Methods for use of yam minisettes were evaluated and practices were established for use of minisett for multiplication of seeds.

c. Purpose and Objectives of ROTREP

Major technical constraints were identified by CNRCIP prior to 1986 that prohibited optimum root and tuber crop production in Cameroon. They can be summarized as follows: the need for an acceptable root rot resistant cocoyam variety; improved methods for rapidly multiplying improved cassava, yam and cocoyam seed stock for distribution to farmers; and development of improved technologies for storage and processing of root crops. It was in response to these constraints that Cameroon was of interest to UMES and AID. The following objectives were developed by ROTREP:

1. develop technically and economically feasible root and tuber rapid seed stock multiplication technology for cassava, yam and cocoyam.

2. develop a root rot resistant cocoyam variety through cytogenetic and breeding studies that have desirable agronomic characters.

3. assess the state of technology on root and tuber crop storage, processing and utilization.

Plant tissue culture techniques were selected as the means for rapid multiplication of root and tuber crop seed-stock multiplication. Tissue culture techniques involve use of specific plant parts (meristems, nodes, callus, etc.) to

regenerate whole plants in culture media containing essential plant nutrients and selected plant hormones. In addition to rapid multiplication, tissue culture techniques permit production of disease free planting material.

d. Evidence and Findings

A schematic presentation of the technical status of cocoyam, yam and cassava research in 1986 and accomplishments of ROTREP toward reaching its technical objectives at the time of this evaluation (August, 1989) are given in Tables 1 and 2. In summary, considerable progress has been made toward accomplishing the technical objectives of the project. ROTREP is to be congratulated for setting up in record time an excellent, functional tissue culture laboratory, greenhouse complex and field experimental site. A number of new developments in tissue culture techniques for root and tuber crops and innovations to reduce costs of materials required for tissue culture practices have already resulted from the work of ROTREP; some of these results may prove to be of major scientific and technical importance and where appropriate should be published or patented (see Tables 1 and 2 for details). ROTREP is also to be commended for completing the diagnostic survey on processing and utilization in an efficient and timely manner.

e. Limitation of Project Assumptions and Design

(1) Objective 1

One of the project objectives is to develop a root rot resistant, agronomically and socially desirable cocoyam culture for agro-ecological zones. An underlying assumption necessary to complete this objective within the time-frame of the project was that locally tested improved cocoyam varieties would be available in the national cocoyam germplasm collection with varying levels of resistance to root rot. It was assumed that within the project's time-frame, these cultivars would be hybridized and progency tested for resistance to root rot and evaluated in agronomic trials. In the first few months of the project, it was recognized that the national germplasm collection had only 30 accessions and that only the yellow type, which does not produce edible corms and is polyploid, is resistant to root rot. Since strategy by ROTREP for developing root rot <u>resistant</u>, acceptable cocoyam varieties of necessity had to change.

Table 1 - Technical Status of ROTREP Research on Cocoyam and Root Rot - August 1989

Project Objective	Technical Status Prior to ROTREP (1978 - 1986)	ROTREP Accomplishments (1986 - 1989)	Relevance/Importance of Accomplishments
Develop a root rot resistant cocoyam variety through cytogenetic and breeding studies that has desirable agronomic character	1. Thirty accessions in CNRCIP collection at Njombe	1. 152 accessions in CNRCIP collection at Njombe and Ekona	1. substantially increased germplasm for screening and crossing
	2. Three types identified- white, red, yellow	2. different chromosome numbers of white and red vs yellow were verified	2. complexity of crossing resistant yellow with preferred white cocoyams has resulted in a new strategy for developing root rot resistance
		-electrophoretic protein characterization completed on 29 accessions	-assists in characterization of different parents and progency
		-leaf and root percent of protein was determined for 40 accessions	-not clearly important at this stage
	3. Causal agent of root rot identified - Pythium myriotylum; poor drainage and pH 5.0 increase root rot	3. Pythium myritoylum has been isolated and grown in culture for field inoculation studies	3. laboratory, greenhouse and field screening for tolerance and resistance can be readily carried out
		on established plants; 12 clones have been identified as tolerant to root rot	
	4. flowering was induced and preliminary hybridization studies were carried out	4. flowering has been induced from tissue culture derived plants	4. crossing of red and white types can occur
		-a breeding block has been established for flower induction and hybridization	-the first generation of progency studies should be completed by 1991
		-800 seedlings have been planted for polyploidization studies	-preliminary results of polyploid studies should be completed by 1991
	5. Agronomic studies evaluated spacing, harvest time location and fertilizer effects on cocoyam yield and growth parameter	5. Soil samples have been analyzed on all field plots being used	5. Agronomic studies will be important as tolerant and resistant cultivars are developed; soil sample analysis and cultural practices will be critical
	-52 accessions have been screened for tolerance to root rot by inoculation with P.myriotylum	-a root rot tolerant cultivar should be identified and tested on site for agronomic traits by 1991	

Table 2 - Technical Status of ROTRE, Research on Rapid Multiplication of Cassava, Yam, and Cocoyam August 1989

Project Objective	Technical Status Prior to ROTREP (1978 - 1986)	ROTREP Accomplishments (1986 - 1989)	Relevance/Importance of Accomplishments
		PRACTICAL	APPLICATIONS
Develop technically and economically feasible root and tuber rapid seedstock multiplication technology for cassava, yam and cocoyam at project site	1. Cassava: use of top (6-7 nodes), middle (2-3) nodes) bottom (2-nodes) of cassava sticks for seed	1. Cassava cultured explants have been subcultured and 2000 plants are available for 1989-1990 field testing.	1. Two years of station field tests of tissue culture derived cassava seedstock should be completed by 1991
	2. Yam: use of "tapping", setts and mini setts to obtain seed	2. 2000 yam explants have been established for 1989-1990 field testing	2. Two years of station field tests of tissue culture derived yam seedstock should be completed by 1991
	3. Cocoyam: use of cormel, corms, suckers for seed	3. 3000 cocoyam explants have been established for 1989-1990 field testing	3. Two years of station field tests of tissue culture derived cocoyam seedstock should be completed by 1991
		1,2,3. Tissue culture derived cassava, yam and cocoyam are presently being evaluated in preliminary field trails	1,2,3. Preliminary results are promising; plants are vigorous
		-acclimatization process for tissue culture derived cocoyam and cassava have been developed; yam processes should be completed before 1990	-labor and time costs for rapid multiplication can be decreased as procedures become routine
		NEW TECHNOLOGY	DEVELOPED
		1. Cassava: modified medium was developed suitable for shoot-tip regeneration	1. Roots and shoots produced at the same time made rapid multiplication possible
		2. Yam: a new method for surface sterilization using calcium hypochlorite was developed for node cuttings	2. Contamination of yam plantlets has been reduced from 80% to 4%; this eliminated the need for use of meristems and made rapid multiplication feasible
		-three media were developed for yam	-two media were for rooting and one was for callus
		3. Cocoyam: two media without growth regulators have been developed	3. Reduces cost and complexity of making the media
		-new medium was formulated for successful multiple bud development of cocoyam	-this is a more reliable method for seedstock multiplication than the recommended procedure for callus development and regeneration
		-secondary buds on rhizomes can be used directly as sources of explants	-this approach enhances mass rapid multiplication since each rhizome has up to 300 secondary buds

(1) Objective 1

Based upon the above findings, a three pronged approach has been developed by ROTREP to produce a root rot resistant, consumer acceptable cocoyam (see Appendix K). Given the project time-frame (1991, we recommend changing the expected output from development and field testing of a resistant variety to selection and rapid multiplication (via tissue culture) and on-site field tests of a root rot tolerant variety. Multi-locational and on farm tests of the tolerant cultivars will most likely require a time-frame past 1991. It is most likely that by 1991 the red type cocoyam (with some resistance) and white type (little resistance) will have been crossed and progeny tested for resistance to root rot and polyploidal character. Preliminary results from crossing progency of red and white types with yellow polyploids is also a realistic expectation within the project's time-frame. It is important to note that this research on selection and hybridization of cocoyam for resistance to root rot represents the most progressive, science-based research on cocoyam of this type and has implications that transcend Cameroon to all cocoyam producing countries of Central and West Africa.

Essential to making optimum progress in the development of root rot tolerant white type cocoyams within the 1991 project time-frame is the need to further expand the germplasm collection of tolerant white type cultivars. It is therefore, important to carry out a survey and collect white type cocoyams in appropriate reigns of neighboring countries to Cameroon, e.g., Ghana, Equatorial Guinea, and Central African Republic and from any other countries with tolerant or resistant germplasm where cocoyams are an important food source. Such a survey should be carried out as soon as possible in 1989 to expand the germplasm base for selection and hybridization studies.

In order to ensure that selection of root rot tolerant cultivars have acceptable quality characteristics such as storageability, cookability, palatability and oxalate content; these and other important quality parameters

should be evaluated in the selection and hybridization processes. A relationship has not been established between cocoyams crude protein content and utilizable protein, other quality parameters or yield characteristics. Therefore, we recommend that quality parameters such as those listed above be evaluated instead of the time consuming semi-micro kjeldahl procedure for crude protein determinations.

(2) Objective 2

It was assumed that on-farm testing of cassava, yam and cocoyam seedstock derived from tissue culture technology could be tested on farmer's farms within the 1991 time-frame. It was further assumed that techniques for rapid tissue culture propagation of yam, cocoyam and cassava were available in the literature and at IITA. This turned out to be an invalid assumption. After starting the project, techniques for cassava were found to be available, but considerable research was required to develop efficient techniques for rapid multiplication of yam and cocoyam. The ROTREP team is to be congratulated for the innovations they have developed in tissue culture techniques for yam and cocoyam. Some of their findings provide new, basic information and practical techniques necessary for future, efficient tissue culture work with root crops (e.g. use of secondary buds of cocoyam, and use of yam node cuttings for tissue culture propagation; (see Table 2). Several innovations were made that reduce costs associated with tissue culture techniques. Despite the time required for the innovations mentioned above, 2000 to 3000 plantlets each of cassava, yam and cocoyam have been or are presently being acclimatized for on-station trials. We recommend that at least two years of on-station field trials should be carried out before on-farm trials are initiated. Thus, ROTREP should consider amending the expected output "of testing farmers' reaction to on-farm trials of tissue culture derived materials by 1991 is a more realistic output. On-farm trials should be planned, for after 1991.

(3) Objective 3

Another project objective is to assess the state of the technology on root and tuber crop storage, processing and utilization. This objective included two components: a diagnostic survey on processing and utilization, and development of recommendations for research needs in processing, on-farm storage and utilization. The diagnostic survey was conducted in November 1987, and the report completed in September 1988. The report provides analysis of 724 households in agro-ecological zones I and II covering the four major root crop producing provinces (Southwest, Northwest, West and Littoral). An analysis for an urban city (Douala) also is provided. The major findings of the analysis were as follows:

1. cocoyam and yam production had increased in four and three of the provinces, respectively, compared to 1984;

2. cassava production had declined in all four provinces compared to 1984;

3. cassava, cocoyam, taro, yams, sweet yam, and sweet potatoes accounted for 30%, 21%, 17%, 13%, 10% and nine percent respectively of the root crops produced in the four provinces;

4. most crops were not harvested immediately after maturity, but were (stored) in the ground and harvested when needed;

5. total post harvest losses were 11% for cocoyam, eight percent for taro, seven percent for cassava and four percent for yams;

6. only seven percent of the total root crops harvested were stored in unprocessed form, and

7. except for specific forms of cassava (gari, fufu, nyondo) methods for storage of processed root and tuber crops are available.

In support of this objective, all persons interviewed (IRA, CNRCIP, UCD, ROTREP, TLU, GATSBY) during this evaluation indicated a major need for research on processing and storage of root crops. The overwhelming consensus was that first priority should be given to improving the efficiency of small and medium scale processing at the farm and village levels, and to improve the nutritional content of the final product processed at these levels. Second priority was development of procedures for large scale operations that could be adopted by private industry for commercialization.

In order to develop specific recommendations for future research on storage, processing and utilization, it was assumed that the Njombe Research Center would be used. This implied the completion of the Food Technology Laboratory at Njombe which had been started but abandoned when the builder's funds were exhausted. Any specific recommendations developed within the project time-frame (1991) will have to consider the fact that because of the present economic crisis, the Food Technology Center has not been completed. In light of this fact, alternative locations for food technology research were discussed during the project review. The general consensus was that the Njombe, IRA Center was the best location for the following reasons:

1. Historically, Njombe has been the Food Technology Center for food crops in Cameroon;

2. The Food Technology Laboratory building is near completion and is located within a few meters of a newly constructed research bakery and the fruit and fermentation laboratories;

3. Njombe is located near Douala, the main commercial city in Cameroon which would facilitate access to the industrialized private sector and availability of imported goods and equipment;

4. Experienced food technology research staff are located at Njombe;

5. Njombe is located in a region where root and tuber crops are a major part of the diet; and

6. The Njombe Center has developed technology being used by private companies (Djanga in Njombe and Mbana in Douala).

f. Technical Staff

The ROTREP project reports (see Appendix D), interviews conducted (see Appendix C), and on-site inspection provided clear evidence that excellent leadership in the science component of the project has been provided. The applied and basic research experience manifested by the senior scientist (breeder/tissue culturist) has been essential for the progress of the project to date. He should be encouraged to maintain the high levels of efficient and science based research and to continue to build interdisciplinary cooperation between research team members. Given the project status and goals and long-term objectives of CNRCIP, consideration should be given by USAID and ROTREP to ensure the continued active involvement by Dr. Wutoh in Objectives 1 and 2 beyond the project's scheduled termination date.

The project breeder joined the project in May, 1988. He has made good progress in preparing for hybridization of clones given the polyploidal character of the yellow type cocoyam. His technical work rates well, but the time-consuming effort on crude protein analysis of leaves and corms appears questionable given the project goals and time-frame.

The phytopathological aspect of the project is the responsibility of Dr. Samuel Nzietchueng, senior plant pathologist, IRA, Dschang, a widely known authority on root rot

disease of cocoyam. Because of his location in Dschang and many other responsibilities, Dr. Nzietchueng has not been consistently available on-site to provide the expertise and leadership in plant pathology that is needed by the project. A Senior Technician, with only six (6) weeks of training in the isolation, maintenance of culture and pathogenicity of pythium followed by periodic meetings with Dr. Nzietchung, has had to carry out the preliminary research reported to date on screening of cocoyam for root rot tolerance and/or resistance. It is anticipated that this person will begin graduate studies in the U.S. in 1990, leaving the project without any trained personnel to carry on the pathology work. Given the project goals and time-frame, we strongly recommend the following actions: A search should begin immediately for an experienced, qualified plant pathology (Ph.D. level) to work with the project in collaboration with Dr. Nzietchueng. The tenure of the plant pathologist should be for one year and he/she should have experience in mass screening for disease resistance. Until such a scientist is recruited, ROTREP should seek to hire a short-term consultant in plant pathology with experience in mass screening for disease resistance and breeding experience to ensure continuity of work that is in progress.

Dr. Zok has made important contributions to the project in the development and application of new tissue culture techniques. Because of Dr. Zok's specialized training and the availability of the tissue culture facility, after 1991 Del Monte, CIP, IITA and others with need should be able to use the facility. Such use may include storage and rapid multiplication of pathogen free bananas, plantains, citrus, coffee, oil palm, fruits (plum and avocado), potatoes, sweet potatoes and cassava. A fee could be charged.

It was a pleasure to hear the enthusiastic reports of the young research staff members including Sama Anne (Senior Technician), Xavier Ndzana (Agronomist), Nyochembeng Leopold (Senior Technician), Tambong James (Agronomist), and Nnoung Arbam Andre (Agricultural Economist). These members of the research team demonstrated a high degree of knowledge about the project purposes and methodologies used, a penchant for hard work and the ability to learn techniques quickly.

It is obvious at this time, that in order to accomplish the project's technical objectives and leave in place Cameroonian scientists experienced and trained in the subject matter specialties required for sustained research, serious consideration should be given to the extension of the project beyond 1991.

g. Recommendations

Given the progress to date and the project time-frame, we suggest that careful consideration be given to the following recommendations.

1. Change the strategy from developing a resistant variety to a tolerant variety by 1991, but continue to pursue the original objective through the hybridization and polyploid studies currently planned; expand the germplasm base of white, tolerant cocoyam through surveys and collections in other countries.

2. Complete two years of on-station testing of tolerant cocoyam varieties, including evaluation of pertinent quality parameters; eliminate on-farm trials until after 1991).

3. Carry out on-station trials of tissue culture derived cassava, yam and cocoyam be 1991. If possible, use several station locations with different soils and agro-ecological conditions. Refrain from on-farm trials until reliable base line information is available.

4. Hire a full-time plant pathologist to work cooperatively with Dr. Nzietchueng as soon as possible; use short-term consultancies of plant pathologists to maintain continuity of the phytopathological components of the project during the search for the full-time pathologist.

5. Encourage MESIRES to complete the Food Technology Laboratory at Njombe.

6. ROTREP should continue to serve as an excellent training ground and model for teaching UCD students and graduates the application of basic sciences in order to solve practical agricultural problems.

7. Given the fact that USAID has designated Cameroon as a technology producing country for the Coastal West Africa ecological zone, the science-based innovations developed by ROTREP during the short period of its existence (see Tables 1, and 2) should be recognized by USAID and IRA as already contributing to this long-term goal. Such

outstanding science and technology generation from ROTREP, if continued, should serve to strengthen the capability of IRA to step up its pace in agricultural technology development.

If a second phase (1991-1996) for ROTREP is considered by USAID, we recommend the following components.

1. Continue the breeding and genetic studies of cocoyam initiated by Phase I.

2. Initiate selected agronomic studies, including adaptability of improved cocoyam varieties to various farming systems in pertinent agro-ecological zones. This should be planned as joint effort with TLU.

3. Distribute and test tissue culture derived cassava, cocoyam and yam seedstock on farms in a cooperative effort with TLU, GATSBY and UCD.

4. Expand the use of the tissue culture laboratory for storage and multiplication of disease-free plants for private industry and other donors/projects on a paying basis.

5. Assuming that the Food Technology Laboratory at Njombe is completed by 1991, initiate targeted research on processing, storage and utilization of root crops. The focus of this work should be directly related to market surveys carried out prior to 1991.

6. During the planning process, keep in mind the list of unresolved issues and questions (see Appendix J) and long-term consideration for agricultural research in Cameroon (see Appendix I).

3. Institutional Development

This section of the report focuses on the relevance of ROTREP in the institutional development of IRA. It comprises four subsections: (1) a brief structure of IRA, (2) a description of the anticipated institutional outcomes of the project, (3) a presentation of the analytical framework used for this evaluation, and (4) the presentation of the findings with the related recommendations.

a. Institutional Setting, Mission and Organizational Structure of IRA

Created in 1974, IRA is one of the five (5) specialized research institutes of MESIRES with a two-fold mission:

1. to develop and carry out research programs relating to all branches of crop improvement, agronomy and forestry,

2. to ensure that research results are disseminated with a view of increasing agricultural and forestry production in Cameroon.

The headquarters of IRA is at Nkolbisson, Yaounde. Its operational structures consist of six (6) centers, 16 stations and 35 antennas (smaller units) spread throughout the diverse ecological areas of Cameroon. Four (4) of the six (6) centers focus on agronomic research and are located at Ekona, Maroua, Njombe and Nkolbisson. The remaining two are based at Nkolbisson; one of them focuses on soils and the other on forestry. Each center has from one to four stations which operate as independent administrative units. The antennas fall under the administrative authority of particular stations. All these operational structures are headed by researchers appointed by government.

For research purposes, IRA is now divided into 16 research programs with food self-sufficiency a first, and export crops a second priority respectively. Priorities under the food self-sufficiency program include cereals, roots and tubers, grain legumes, vegetables, food technology, plantains and bananas, fruits including pineapples, and attention to soil science and conservation, conservation of genetic resources and farming systems research. Export crops include stimulants (coffee and cocoa), cotton, rubber, oil palm, forestry, and botanical crops.

Depending on the crops concerned, some of the 16 programs are carried out at specific centers or stations, others have a national coverage. Each program is headed by a chief of program located at one of the centers.

For the particular case of Cameroon National Root Crops Improvement Program (CNRCIP) under which ROTREP operates, the chief of CNRCIP is also the chief of the Ekona Center which serves as the headquarters of ROTREP.

b. Anticipated Institutional Outcomes of ROTREP

The primary purpose of ROTREP is to assist IRA in root and tuber food crops research. The attainment of this purpose is expected to produce the following outputs:

- the establishment of a tissue culture laboratory that supports seedstock multiplication and agronomic research,

- the training of four (4) Cameroonians at the M.Sc. level and two (2) at the Ph.D. level in project related subjects,

- the training of six (6) Cameroonians in project related areas (in USA, Cameroon and third countries) through short-term programs (courses or workshops)

- the demonstration of developing rapid seedstock multiplication system through on farm research.

Thus, contrary to other projects where institutional development is referred to, in broad terms with no specific guidelines, the project document for ROTREP clearly indicates its anticipated outcomes.

c. Framework for Institutional Analysis

The analytical framework used for this evaluation is derived from a model of institutional development which, in the particular case of sustainable research, has the following properties: (1) adequate physical structures and facilities; (2) sufficient qualified researchers, technical and administrative/support staff; (3) effective methods of dealing (linkages) with other institutions; and (4) appropriate funds to fulfill its mandate. When this model is matched with the anticipated outputs of ROTREP, the following observations can be made. Output (a) is supposed to meet Requirement 1, outputs (b) and (c) are supposed to meet Requirement 2, while output (d) falls under Requirement 3. With regard to the last Requirement related to the funding of the institution, it one of the preconditions to the fulfillment of the anticipated outputs of any project. The issue of funds critical for the sustainability of ROTREP is dealt with in the economic and management sections of the Report. Therefore, reference to this issue will occupy a marginal place in this section.

d. Findings and Recommendations

The presentation and discussion of findings pertaining to the contribution of ROTREP to the institutional development of IRA are made under three headings derived from the first three Requirements for institutional development, namely: (a) physical structures and equipments; (b) human resources development; and, (c) linkages with other institutions. Some anticipated outcomes as well as their implications for the project will be discussed where appropriate.

(1) Physical Structures and Equipments

Buildings and facilities are physical and cultural symbols of an institution. For instance, it is hard to think of religion without a church edifice, of education without school building, and of research without a laboratory. In the case of ROTREP, the tissue culture laboratory and the greenhouses stand out as its two major cultural symbols.

These two physical structures play a critical role in the rapid multiplication of improved seed plants for root and tuber crops. They do, in fact, fill an important gap in the CNRCIP.

The tissue culture laboratory has been completed in record time (less than six months). All equipment and facilities needed for this laboratory have been received and tested. The laboratory is now functional. Of the two greenhouses to be constructed, one is already completed. The second should be completed soon.

The successful achievement of this anticipated output is rather surprising when compared to frequent negative performance in construction experienced by other projects in Cameroon. The effective collaboration between the parties involved in this project, their efforts to meet their commitment as well as close supervision of the construction are the key factors that led to this excellent achievement.

The equipment and facilitates used by ROTREP scientists will increase the credibility of their research results. This credibility is essential if IRA has to play the technology generating role assigned to Cameroon by USAID and other International agencies.

(2) Human Resource Development

The availability of sufficient qualified personnel (researchers, technical and administrative support staff) is critical to the fulfillment of the various activities of ROTREP. Given the newness of the tissue culture laboratory and other related equipments, the training of people for their efficient use is an important requirement both for the short and long-term sustainability of the project. Three forms of training have been considered for this evaluation, namely: on-the-job training, short-term and long-term training.

(a) On-the-job Training

This output is not mentioned in the project document. However, observations on the project site have indicated that a very positive job has been done in this area. ROTREP technical assistants and senior Cameroonian researchers of CNRCIP have managed to train junior level staff (two engineers and three technicians) in genetics, plant breeding, tissue culture, plant pathology and agricultural economics (see Appendix F). These junior level staff are now able to carry out various activities related to ROTREP either in the tissue culture laboratory, or in experimental field plots.

One clear evidence of the efficiency of this form of training is the important number of publications co-authored by technical assistants, senior and junior Cameroonian researchers, and with some technicians. This also indicates the healthy collaborative approach involving

the technical assistants and all their counterparts.

The impact of this on-the-job training also is reflected in the positive technical and scientific results so far achieved by ROTREP. The experience gained will also be beneficial for participants undertaking graduate studies.

Administrative support personnel have also benefited from training in computer and telex operations (see Appendix F). This has had a positive impact on their performance.

Given the overall positive impact of on-the-job training both for the project scientific output and for the professional development of junior researcher and administrative support personnel, it is recommended that this form of training be continued and be added to the log-frame.

(b) Short-term Training

There is a provision for short-term training of Cameroonians in the project. Three categories of personnel have been identified as needing this type of training, namely: (a) research personnel; (b) research support personnel; and, (c) administrative support personnel. So far, three persons selected from the above categories have benefited from these training opportunities (see Appendix F). Thus, 50% of the expected output have been achieved. The three participants include:

- a tissue culture researcher who went for a one week study tour at IITA in Nigeria.

- an administrative secretary identified to become the administrative assistant for the field office spent two (2) months at UMES (USA)

- an electrician who spent three (3) months in the USA for training as an instrumentation person.

- Participants' self evaluation of their short training programs is very positive. The impact of the newly acquired skills is particularly felt at the level of the research and the administrative personnel. The first one is now handling, with a comfortable degree of efficiency, various maintenance problems related to the tissue culture laboratory. The second one is now in charge of all the administrative and financial problems of the project and has also been able to train another administrative support person in word processing. The decision to raise a secretary to the level of an administrative assistant was a courageous and cost saving one as this position should normally have been occupied by an administrative technical assistant. The lesson to be learned from this initiative is that in some areas, the need for technical assistance can be met through short term training of local personnel.

- Since no research support personnel in tissue culture, plant breeding, and plant pathology was among the first group of beneficiaries, it is recommended that the remaining three short-term training slots be given to candidates from these areas within the time limit of the first phase of the project.

- Moreover, if, as recommended, Phase II of the project is funded new short-term training opportunities in Cameroon or abroad should be considered in the design of this project.

(c) Long-term Training

The initial number planned for long-term training was six (6) Cameroonians. It was later reduced to five (5) as the result of the proposal to transfer to ROTREP a Cameroonian senior researcher who was expected to complete a Ph.D. in July 1988 at the University of Ibadan. His work on the breeding of cocoyam for resistance to root blight complex is very relevant to ROTREP research objectives.

For the remaining five positions, two Cameroonians are presently studying Food Science (Ph.D.) and Food Technology (M.Sc.) in the USA. Two other candidates have now been identified for M.S. programs in plant breeding and tissue culture. They are planning to leave for the USA in January 1990. Their respective host universities have not yet been determined.

From the above, it is clear that only one counterpart, the one engaged in Master of Science in Food Technology will be able to complete his program by 1991 (see Appendix F). This low achievement is due to over optimistic assumptions both on the availability of counterparts for the project (see Appendix G) and on the length of time needed to process their applications for study leave. In addition, the time requirement for getting students accepted into US Universities seems to have been overlooked.

ROTREP and IRA officials should find a better way to speedup the long-term training. Counterparts should also be informed of the progress made with their applications to avoid being caught by surprise when they have to leave. One of the first steps to be taken is to have at the level of IRA headquarters somebody in charge of handling

applications for study abroad for all IRA personnel.

With regard to the number of counterparts initially planned to be trained in the project, the possibility of upward and geographical mobility of researchers should have been taken into account. This should still be done to ensure the continuation of research activities even if one researcher is no longer available. In addition, the interaction between two researchers working on the same problems will also have a positive effect on their achievement. In brief, a one-man show has to be systematically avoided. As a result of this concern, there is a need to assign another counterpart to the agricultural economist to reinforce ROTREP research activities in this field, and, at the same time, ensure the continuity after the departure for graduate training of the one who recently joined the project.

The final comment of the counterpart issue is related to the level at which the majority of them are to be trained. The M.S. level is not adequate training for effective research and promotion. Provision should therefore be made to ensure that participants with the M.S. degree will have an opportunity, after a prescribed time of field work, to undertake a doctoral program.

Given the need to have a smooth transition between senior technical persons and their counterparts, the present delay in the implementation of the long-term training component of the project, and the necessity for further training of participants at the M.S. level, it is recommended that the Technical assistance component of the project be continued beyond 1991. The position of the third scientist (plant

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breeding) is of immediate concern as it is currently funded only until April 1990. Given the importance of plant breeding to the project, it is imperative that appropriate funding be made available to the project for continuation of this position at least until 1991.

(3) Linkages with Other Institutions

No institution operates in a vacuum. ROTREP is a relatively autonomous entity (with its specific objectives, formal and informal structures, budget, personnel, code of behavior, etc.) However, it operates within CNRCIP, which itself is part of IRA, one of the five research institutions of MESIRES. As such, the overall performance of ROTREP will, to a large extent, depend upon the type of relationships it will be able to develop with its surrounding institutions inside and outside of MESIRES. Communication is critical in any type of relationship. With the establishment of direct telephone lines and a telex machine at Ekona, in addition to any existing radio system, ROTREP has reinforced its of contacts with surrounding institutions.

In pursuing its objectives, ROTREP has already developed a network of formal and informal linkages. Some of these linkages were anticipated, others were not. Dr. Lyonga and Dr. Acquah have to be commended for playing a key role in initiating these linkages. The aim here is to comment on some of the existing linkages and to explore the new ones that can be established later on by ROTREP.

(a) Link with the GATSBY Charitable Foundation

GATSBY, an England based foundation, has been funding some CNRCIP research activities in agro-ecological zone I, II and IV since 1986. GATSBY funds are used to pay IITA staff who do the work, and the training of Cameroonians under the program. The technical objective of this project is to train farmers, through demonstration of the method for

rapid multiplication (minikits) of improved planting material for root and tuber crops (mainly cassava) in major growing areas. After an initial short period of confusion when ROTREP was thought to duplicate GATSBY's activities, the complementarity of these two projects is now understood and accepted. The two projects have now developed good working relationships, and GATSBY Technicians have access to the tissue culture facility. These relations are likely to be reinforced when ROTREP will move into on-farm trials of tissue culture propagated seed-stock. GATSBY funded researchers have developed direct working programs with the extension service at the subdivision level in areas where they work with selected farmers. Later, ROTREP can use these channels where suited.

(b) Link with the National Cereals Research and Extension Project (NCRE)

NCRE is the major USAID funded research project in Cameroon. This project was conceived and designed in the late 1970s as a means to assist the government of Cameroon to achieve its long-term production goal for maize, rice, sorghum and millet. This project within IRA is implemented by IITA, under contract with USAID. The relations between ROTREP and NCRE were formalized on July 27, 1988, with the signing of a Memorandum of Understanding (MOU) between IITA and the Consortium of three 1890 Land-Grant Universities. The most important linkage between ROTREP and NCRE is at the level of the NCRE Testing and Liaison Unit (TLU). This unit was developed by NCRE to establish linkages between researchers, extension workers, and farmers. Though its primary focus is on cereals, its mandate has now been broadened with the adoption of a farming systems methodology. The focus of the

new approach is "on-farm trials". Root and tuber crops are now being included in the trials in appropriate agri-ecological zones as soon as improved technological packages are developed for these crops. At Ekona where ROTREP is located, the TLU team consists of a socio-economists, two agronomist, agricultural economist, economist, extension agronomist and several technicians.

Given the fact that farming systems in the agri-ecological zones covered by the Ekona based TLU has roots and tubers as dominant crops, there is great potential for collaboration between the Ekona based TLU and ROTREP. The relations between the two are still informal and need to be systematized. They can and should be strengthened in the future to avoid duplication of efforts and waste of scarce human, material and financial resources.

Members of the Ekona TLU unit have already accumulated valuable information on the farming systems in the Southwest province. They can be of great assistance to ROTREP in its agro-economic studies related to root and tuber crops. For on-farm trials, the TLU unit has also developed good working relationships with farmer groups and local extension agents--with informal approval of the local Provincial Delegate of Agriculture. These networks can be useful for on-farm trials of ROTREP. However, given the limited scientific and technical expertise on root and tuber crops of TLU members, we recommend that ROTREP associate with TLU at the level of on-station trials and assist them later on on-farm trials.

(c) Link with IRA - International Potatoes Center

The International Potatoes Center (CIP), based in Peru, has recently established its regional center for Central Africa at Bamenda in the Northwest Province. CIP research activities in Cameroon are part of CNRCIP. This project has already contacted ROTREP for the use of the Tissue Culture laboratory. Although this was not anticipated, this demand reinforces the functional utility of this laboratory within CNRCIP.

(d) Relations with the Opportunity Industrialization Center (OIC) Buea

OIC is an USAID funded project. Participants of this project help ROTREP to solve some minor construction and maintenance problems. This has reduced recurrent costs of the project.

(e) Link with the University Center of Dschang

Established in 1977, the University of Dschang (UCD) is under MESIRES. Its mandatory missions are Teaching, Research and Outreach activities. UCD has about 130 full-time academic faculty and is partially funded by the USA, Belgium and France. Following an Agreement signed between the U.S. and Cameroon in 1982, UCD should be developed as a Land-Grant type institution. UCD was reorganized in October 1988. Its two former teaching institutions: the Institute of Agricultural Technology (ITA), and the National Advanced School of Agriculture (ENSA), were replaced by a newly created one: the National Institute of Rural Development (INADER). The degree programs of UCD have been restructured and consolidated and its research and extension (outreach) mission re-emphasized. ROTREP's relationship with UCD has been informal and has focused on training of UCD students. Since the

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1987/88 academic year, five students from the different cycles have completed their internship (field work) at Ekona, using ROTREP facilities, under the supervision of ROTREP scientists. A group of four students is planning to join ROTREP in the 1989/1990 academic year (see Appendix G).

It is becoming clear that informal working relation with UCD should be made more formal. If not, ROTREP may receive more students than its facilities and scientists can handle, or topics on which students work may not always be in line with ROTREP research priorities, therefore supervising them would become an additional effort.

These potential problems can be avoided if at the end of each academic year, ROTREP scientists provide UCD a list of topics they would like students to work on and the number of students of each cycle they are willing to accept. In addition to supervising student work at Ekona, ROTREP scientists can also contribute to their training in Dschang as part-time lecturers, specifically in tissue culture. UCD has already contacted one of them for that purpose.

Future relations between ROTREP and UCD can be broadened to include research and extension, the two other mandatory missions of UCD. Given the number and expertise of UCD lecturers, they can work jointly with ROTREP scientists in some specific areas. One UCD lecturer, a virologist has already worked for ROTREP but this was in a consultancy situation. It needs not be the case in the future if the two groups of scientists develop joint research proposals based on ROTREP research priorities. The case of agricultural economics and related topics is a typical example.

It will even be possible to station some UCD lecturers at Ekona if their research interests call for continuous use of the tissue culture laboratory or of other appropriate facilities. The general MOU that already exists between UCD and IRA on the use of Laboratory equipments, can provide the basis for such a collaboration.

In the area of extension, when ROTREP reaches the stage of producing extension bulletins for farmers, UCD lecturers who are specialized in communication can be called upon to assist. This will simply be an expansion of an existing arrangement wherein NCRE and GATSBY have initiated direct contacts with potential users of their research results, with some degree of success. However, overall positive impact of research results obtained whether by ROTREP, CNRCIP or any other research program, on Cameroonian farming communities will be achieved not through these "piece meal" approaches but through an overall solution, at the national level utilizing effective linkages between research and extension institutions. This, of course is beyond the scope of work of the mid-term Evaluation Team of ROTREP.

A synopsis of ROTREP existing and possible future linkages with surrounding institutions is given in Table 3.

TABLE - 3

SYNOPSIS OF ROTREP EXISTING AND POSSIBLE FUTURE LINKAGES WITH OTHER INSTITUTIONS

Name of the Institution	Areas of collaboration
GASTBY Charitable Foundation	- Improved varieties - Tissue culture laboratory - Contacts with extension workers - Contacts with selected farmers
National Cereals Research and Extension - Testing and Liaison Unit (NCRE - TLU)	- Information on farming systems - Market surveys - On-station-trials - Contacts with extension workers - Contacts with farmers - Technical advice - Supply of seedstock
IRA-International Potato Center (CIP)	- Tissue culture
Opportunity Industrialization Center (UIC)	- Minor constructions - Minor maintenance
University Center of Dschang (UCD)	- Training of students - internship (field work) - lectures - Joint research projects - Extension bulletins - Library - Use of equipment and facilities - Publications
To be explored:	
- Agric. Development Corporations - Non governmental organization - Private entrepreneurs - Ministry of agriculture	- On-farm trials - Distribution of seedstock - Contacts with farmers - Training of Technicians - Survey - Statistical data

(f) Other Linkages to be established

When ROTREP reaches the stage of mass production of seedstock, while waiting for the privatization of this activity, the problem of their distribution to needy farmers will become critical. This problem has to be addressed now if ROTREP wants to achieve its goal of assisting in the improvement of the socio-economic welfare of Cameroon farmers through increased productivity of root and tuber food crops.

Cameroon officials under ROTREP operations have to initiate contact with both the Ministry of Agriculture, which is responsible for extension service at the national level, and the various other relevant organs operating in agriculture.

(g) Recommendations and Summary

The excellent cooperation between all the parties that led to the rapid completion of the physical structures of ROTREP should be maintained and developed in all activities related to ROTREP.

- On-the-job training should be continued and added to the log frame.

- New short term training opportunities in Cameroon or abroad should be considered in the design of this project if Phase II is funded.

- Ways of speeding up the identification of counterparts and hastening their departure for graduate training should be found through appropriate methods by ROTREP and IRA Directorate.

- Provisions should be made for further training of counterparts up to the Ph.D level to increase their efficiency and improve their career prospects in research.

- The number of counterparts should be revised in order to have at least two for each discipline to ensure continuation of all ROTREP activities even if one researcher is unavailable. Of immediate concern is the need for another counterpart for the Agricultural Economist Scientist.

- Given the need for a smooth transition between the technical scientists and their counterparts, the technical scientists' contract should be extended beyond 1991. Of immediate concern is the need to find funds for the continuation of the plant breeder position until at least 1991.

- ROTREP should maintain and strengthen the linkages already established with surrounding institutions. A particular focus should be on the links with NCRE-TLU and UCD which have to be fully explored and formalized.

4. Economic Oversight and Implications for Expanded Production

Although the scope of work required no separate section on economic implications of assistance to ROTREP, the economic crisis has spillover effects on all development processes. Moreover, one might ask what does history teach about the viability of research ventures in Africa, and finally what are the implications for sustainability and future economic growth? With these thoughts in mind, the Evaluation Team decided to add this section to the evaluation.

(a) General Information

The World Bank, numerous other development studies, the Ministry of Agriculture (MOA), and MESIRES have all provided detailed information on Cameroon's agricultural economy. We need only to highlight a few key data in this limited evaluation.

Cameroon's population is estimated to be about 10.8 million spread over 475,000 km. of rather diverse climatic zones. The man:land ratio therefore is modest, but population growth rate is high at 3.4%. With oil offering a pull effect, rural to urban migration has accelerated in recent years to the extent that

about one-third of the population now lives off-farms. This figure is still rising.

For agriculture, one concern is the age distribution of farm operators with 54% percent over 44 years and only 5% under 24 years (MOA-Farm and Farm Characteristics, Farming Methods and Practices, 1988). When these data are combined with the fact that 60% of the farm operators had no education in 1984, it would appear that a high proportion of migrants are the younger and better educated among the rural population.

The 1.2 million farms in Cameroon are small averaging 1.7 hectares (ha.) per unit. Of the total, 97% grow food crops of which roots and tubers are of great importance, averaging about .5 ha. per farm. Capital on farms consists mainly of handtools, and hand labor is the principal source of farm energy. Only 2% of the farms (mainly in the North) employ tractors.

To put in perspective, the ultimate success of the ROTREP project will depend on the functioning of an agricultural economy that is dominated

by a large number of small widely dispersed farms using traditional methods and operating under customary tenure (only 2.4 percent of operators held land titles).

(b) ROTREP and the Economic Crisis

Through the 1970s and early 1980s Cameroon was thought to be an economic model for Africa. It was self-sufficient, or nearly so, in the basic foods, its poultry industry was growing and its agricultural exports were substantial and diversified. The institutions that support agriculture - research, extension, cooperatives - were quite visible with rapidly expanding infrastructure and consistent support from government units and parastatals.

Financially, the economy was well off with per capita income above $800.00. There was supposedly a sizable surplus in the agricultural stabilization fund which was designed for drawdowns in unexpected bad times. The entire economy was undergirded by a modest but rewarding oil export.

From mid-1985 and into 1986 and beyond, the international prices of oil, coffee and cocoa (80% of exports) fell significantly at nearly the same time. What had appeared to be an adequately managed Macro economic system began to fall apart (see USAID's CDSS). GDP fell from an annual growth rate above 3% to a 6.8% deficit over the past three years (World Bank, Cameroon Agricultural Sector Review, 1989). The Stabilization Fund proved far too puny and marketing boards have had difficulty paying for export crops. Most operating costs beyond wages and salaries (and related benefits) dried up, and a freeze was put on new hires.

One comparative bright spot in the economy has been in food production and sale of food as wage goods. Without a doubt Cameroon's wage and salary scales are unusually high thus consumers continued to hold substantial purchasing power. Some farmers are said to be switching from export crops to more food crops and food prices have remained relatively stable.

Until now ROTREP has been affected but little by the crisis. Whereas USAID took eye-raising, but considered, measures by shifting heavily toward non-project assistance and encouragement of reforms, selected projects, including ROTREP, remain in its "core" program and in fact are recommended for forward funding for the next five years. GRC, in spite of the crisis, is maintaining its agreed contribution to the project including significant recent contributions to capital costs. Without doubt, however, the caution flag is up, and those managing the project have been advised to act accordingly.

(c) Economic Analyses Under The Project

The Chief-of-Party (COP) of the ROTREP project is himself also its agricultural economist. The project recognizes the importance of agricultural economics in that ultimately, the project should more than pay its way. He therefore has laid out a large and comprehensive economics program, but was not able to obtain an understudy until February 1989. Since then two enumerators (not trained in economics) have been

added. However, since the Chief-of-Party has given almost all his time to project start-up, administrative details and general project oversight, little time has been left for economic analysis.

The economic program (still on paper for the most part) is being developed with the view that the planting material being produced (via tissue culture method) should be economically rewarding to farmers who adopt the seed-stock and to investors who market the materials, and others who can employ tissue culture methods by using locally purchased equipment at greatly reduced costs. The project trained electrician/mechanic and the chief scientists are working on this latter possibility. The program has four points of focus viz: 1) market price surveys of root and tuber commodities in the four highest producing provinces, 2) the economics of on-station and on-farm testing programs in cocoyam yam breeding, 3) productivity analysis among farmers in root and tuber based cropping systems, and 4) economics of rapid seed-stock

multiplication. The market surveys have been commenced in Southwest Province, 35 farmers have been selected to begin a pilot study of farmer responses in root crop systems, and a preliminary cost study of plantlets using tissue culture method has been conducted.

(d) Comments

As stated throughout this report no root and tuber seed-stock has been released from the project, thus detailed economic analysis is premature. In any case, the Evaluation Team takes the view that the ROTREP economic program as laid out (see Appendix H) while laudatory in its thoughtfulness and intent, is considerably beyond the scope of the project as gleaned from the log-frame and from available resources.

For example, the market price surveys propose to cover markets in four large provinces, each of which contains a considerable number of markets. The team is aware that these markets may have different characteristics, but meaningful on-going surveys would require numerous enumerators, large transport costs, and eventually a computerized data system.

The Evaluation Team suggests that the economic element of ROTREP be pared back to a scale that is more commensurate with available resources. More specifically, we suggest that the market surveys on roots and tubers be confined to sample areas of Southwest Province. For the productivity analysis on roots and tuber based on cropping systems, other sample groups of farmers should be selected for study, but again within the known scope of resources available to the project. It is unlikely that GRC will be able to enlarge its contribution. Beyond these two elements of the proposed program, we suggest that ROTREP rely heavily on TLU for on-farm tests of new planting materials. In addition, TLU officers are prepared to share their own market price data with ROTREP. Agricultural economics expertise at UCD also may be called upon to complement the needs of ROTREP. These are all costs reducing measures.

As noted in the proposal, the cocoyam breeding activity will not be ready for meaningful economics analysis before 1992. If a phase II of

the project is funded more consideration can be given at that time.

Again, the Evaluation Team has no problem with the content nor the eventual need for an economics program such as that proposed. Its scope, however, is more appropriate for the station's program rather than for a medium size project within the program.

(e) Historical/Institutional Tests

One test of viability for projects such as ROTREP is a historical one of past research institutions that have been successful in Africa. Professor Eicher of Michigan State University has looked into the nature of sustainable research institutions. In his findings, he agrees with A.I.D that the chances of high pay-off from agricultural research in Africa improve greatly if assistance is concentrated at national agricultural research systems (NARS) in advanced (technology producing) African countries (see Carl Eicher, 1988). Cameroon has been designated such a country thus on this count ROTREP qualifies. Eicher notes further that

neither resource transfer research models nor export crop-led, heavily funded research models (e.g. IBRD recommendations) have been successful, thus research should be commodity and site specific, carefully funded and based on conditions of the local environments. ROTREP falls within these guidelines.

Dating back to the colonial era, small teams of 3-6 scientists working on specific commodity focused research have made the breakthroughs in Africa - maize in Kenya and Zimbabwe, cotton in Uganda and Sudan, oil palm in Zaire are examples. Again ROTREP meets the test. A third test for sustainability is that donor assistance be cast at a deliberate pace and at a level of effort that Africa economies can absorb and host country treasuries and skill levels can sustain these efforts after donor phaseout.

The Evaluation Team can go further and say that ROTREP has selected a category of crops that are crucial to the food economy of Cameroon, the quality of the research is sound, overall management of the project is excellent and until now GRC support has been

good. Based on the all points above, ROTREP ranks well.

(f) Future Projections

Economists are not only concerned about the present economic implications of ROTREP, but also future ones. The central issues raised are about sustainability and impact.

Those who are worried about sustainability of the project at the point of A.I.D./UMES phaseout ask: what happens to the rather sophisticated laboratory equipment after project phaseout? Are there technical skills and foreign exchange to keep the project operational? Suppose the project is successful and produces large quantities of improved seed-stock as expected, who will deliver it to farmers and what might they be charged? If as surmised, the ground is to be laid for private initiative to become involved in a cheaper level of production and delivery, how will this be initiated? These are all realistic questions that deserve answers though only partial ones can be provided at this time.

As for repairs and upkeep of equipment, a short-term trainee went to the U.S. to upgrade his skills on the kind of equipment that was being shipped. It is crucial that he be retained at Ekona, and that other equipment technicians be trained. Seedstock normally is distributed by the extension service. However, in Northern Cameroon 54% of the farmers buy seed such as maize and groundnuts from other farmers at local markets. If handled with care, it is possible that local traders could use local markets as distribution points for root and tuber seedlings. Finally, A.I.D.'s thinking and effort about phasing out projects should be commensurate with that of initiating them. It is the team's opinion that good projects should not be phased out (projected termination dates notwithstanding) until AID has made intensive effort to ensure that the host government is definitely phased in - financially, access to repair equipment skillwise and for manpower generally. Beyond this we can only say that the red flag on sustainability be held up through constant reminders to the host government over the life of the project.

As for project impact (i.e. growth generating impact), again let us suppose that the project is successful, that farmers accept and use the improved seed stock, that production increases and results in root and tuber surpluses. What then? Of course, these questions are beyond the scope of the project as presently designed, nonetheless, they are relevant to the discussion.

It is evident that donors and African countries have been so obsessed with increasing primary production, basic human needs, and policy dialogue, that demand and market expansion issues have been totally ignored. We overlook how growth is to occur. The classic paradigm in this regard is that a breakthrough in technology (from research) occurs, production rises and results in decreased costs of food production per unit. With increased supply, the price of food decreases, which being a popular wage good, the demand for these products also increases such that farmers maintain high production while selling at a lower price and still maintaining high profit margins. During the next round consumers

with more real income would demand superior farm produce - meat, fish, protein - (Engle's Law) encouraging farmers and fishermen to produce more of these commodities. If trade between rural and urban populations is open farmers with increased income will demand more urban processed goods (consumer and capital) giving the growth process a circular movement leading to general economic growth.

Obviously if root and tuber crops receive a technological breakthrough from ROTREP leading to significant increases in production, transformation possibilities and market expansion would become urgent.

Because of this possibility, the Evaluation Team has attempted to match steps that are occurring on the production (supply) side, and which can occur in the future at project level, with related actions that should be initiated concomitantly on the demand side if product transformation, market expansion and growth are to be achieved (Table 4).

Of course during ROTREP's start-up including the installation of the laboratory, and the early breeding work on

cocoyams, no relationships for processing and market expansion existed. However, now that the tissue culture laboratory has started producing, and greenhouses have been built, on-station production of plantlets and on-station testing can commence. We therefore should begin research and related work on food technology. This would be the first step toward transformation possibilities, taste testing and the possibility of increased demand for these products on local markets. On-farm trials, marketing and distribution of the new seed-stock should continue and should parallel food technology research. If, as expected, significant increases in production actually occur, regional and international markets should be explored and sales promotion should be financed in an attempt to expand demand for roots and tubers in these markets. Success would mean economic growth and increased employment for Cameroon's economy as a whole.

The Evaluation team would caution, however, that persons looking into sales promotion and

market expansion should be selected on the basis of previous experience with marketing new products. Perhaps a recently retired business and a marketing economist could lead a two-person team for this purpose.

TABLE 4

RELATIONSHIP BETWEEN CURRENT AND ANTICIPATED ACTION UNDER ROTREP PROJECT AND NEEDED ACTION ON FOOD TECHNOLOGY, UTILIZATION MARKET EXPANSION AND DEMAND FOR ROOT AND TUBER PRODUCTS

YEARS	STEPS TO ACHIEVE SIGNIFICANTLY INCREASED PRODUCTION OF ROOT & TUBER CROPS	IMPLIED ACTION ON FOOD TECHNOLOGY, PROCESSING MARKET EXPANSION AND INCREASED DEMAND
1987-88	ROTREP	NONE IMMINENTLY REQUIRED
1987-88	Breeding on cocoyam begins	" " "
1988-89	Tissue culture lab. installed, Production begins	Training of Food Technologists should begin
1988-89	Green houses built	Food technology laboratory should be made ready
1989-91	On-station testing and moving toward on-farm testing	Food technology laboratory should be completed
1991-92	Substantiate that seed-stock of high yielding variety and acceptable to farmers	New laboratory produced products should be market tested on local market
1991-92	New seed-stock available to farmers in increasing volume	Increases in support of Root and Tuber Crop Recorded
1992-96	Project turns to more processing, storage and harvest problems	Ensure that products are high quality
1992-96	Private investors producing and marketing improved seed-stock by simplified tissue culture method	More Products derived from root and tuber crops on Domestic Market. Team now exploring market demand in Regional and International markets
1996-	Large surpluses of root and tuber crops being produced	Surrounding African countries and European countries buying increased tonnage of root and tuber products
1996-	High production continues	Export sales climb

APPENDICES

A. STATEMENT OF WORK

B. LOGICAL FRAMEWORK

C. PERSONS CONTACTED - ROTREP EVALUATION

D. REFERENCES

E. SHORT RESUME OF TEAM MEMBERS

F. ON-THE-JOB TRAINING UNDER ROTREP

G. DATE OF ASSUMPTION OF DUTY OF CAMEROONIAN RESEARCHERS ASSIGNED TO ROTREP

H. PROPOSED ROTREP ECONOMIC PROGRAM

I. SOME LONG-TERM CONSIDERATIONS FOR AGRICULTURAL RESEARCH IN CAMEROON - A CONCEPTUAL NOTE

J. UNRESOLVED ISSUES/QUESTIONS TO BE CONSIDERED IN FUTURE RESEARCH AND PROPOSAL DEVELOPMENT

K. REPORT ON STRATEGY FOR COCOYAM BREEDING

L. COMMERCIAL PRODUCTION

M. SCOPE OF WORK

N. ROTREP EVALUATION SCHEDULE

IV.

STATEMENT OF WORK

Prior to the field visit the prime contractor shall provide the US based evaluation team members with relevant resource materials so that they may become familiar with the goals and purposes of the project.

Guidance and direction during the evaluation team field visit will be provided by USAID Cameroon. The team, under the supervision of the Team Leader and with assistance of the Project Manager, Director of IRA and Chief of Party, shall address the following questions:

A. TECHNICAL ASSISTANCE

1. What are the major project accomplishments to date?
2. Given the progress/accomplishments made to date what is the likelihood that the following objectives will be achieved by 1991?

   (a) Develop locally acceptable variety of cocoyam resistant to root rot and blight complex.

   (b) Develop feasible (technical and economical) yam, cassava and cocoyam rapid seed stock multiplication system.

   (c) A survey report with identification of researchable problems relating to post harvest losses of root and tuber food crops and recommend opportunities for improving storage, processing and utilization.

   (d) Assist in the institutional development of IRA in root and tuber food crops research.

3. Are the assumptions on which the project design was based still considered valid?

4. Is the overall project design considered both valid and appropriate in the present context?

5. Is the Technical Staff adequate and appropriate to accomplish the project purposes?

6. What are the major adjustments needed in the scope of work for the project to accomplish its purposes?

7. Are there similarities or complimentarity with activities being undertaken by ROTREP and the activities of the CNRCIP?

8. What are the major technical constraints to date in implementing the project and how can they best be resolved?

B. PROJECT MANAGEMENT AND ADMINISTRATION

1. What is the grantee's management capability and commitment in implementing the project?

   Long term personnel utilized, tenure track personnel, home campus administrative commitment, budget and financial management, commodity procurement process, storage, distribution and resupply systems.

2. How is the management of the project integrated into the IRA System?

3. Is the Executive Committee concept of Project Management as practiced in ROTREP effective vis-a vis. traditional USAID management style.

4. What are the social, political and economic benefits to be derived from this project, (include public awareness)?.

5. Have relationships and linkages been developed with other AID funded projects, other domestic and international institutions?.

6. How appropriate is the project field administrative structure. Are staff members adequate and appropriate for assigned tasks?.

7. Are there unanticipated benefits from the project?

8. What are the major issues to be addressed by USAID, MESIRES/IRA and or the cooperating institutions?

C. **PARTICIPANT TRAINING**

1. Have the training activities been conducted according to plan?.

2. Are the allocated longterm and shortterm training slots adequate to support and sustain root and tuber food crops research in Cameroon?.

3. Are there constraints in training, and how may they be alleviated?

D. FINANCIAL MANAGEMENT AND CONTROL

1. Is the funding level adequate to accomplish the project purposes?.

2. Is the financial management system adequate i.e. (control of working fund, reconciliation of funds, financial record keeping system)?.

3. Is the GRC contribution in line with USAID expectations?

4. Are there major constraint in financial management?

E. GENERAL

1. What are the prospects for both the financial and institutional sustainability of project activities after the completion of USAID assistance?

2. What is the relevance of the project in the hierarchy of agricultural research prioritization in IRA?.

METHODS AND PROCEDURES

The entire evaluation process is expected to take three weeks to complete; with a six (6) day work week. The evaluation will start on July 26 with a two day orientation/observation at the project office at UMES and one day orientation at USAID/ Yaounde. The team will spend about one week visiting and observing project activities in the field.

The primarily sources of information for the team will be existing written information (Project documents, Reports, Papers, etc). Interviews with project staff, USAID staff and GRC Officials through rapid reconnaissance method will be essential.

The team will provide a first draft of their report for USAID/GRC/Grantee comments and make the revision if necessary in the field. The team is expected to have a nearly final form of its report before departing for USA. The submission of the final report is expected within two weeks after departure from Cameroon.

VI. EVALUATION TEAM COMPOSITION

The project evaluation is a joint effort between USAID, GRC and the Contractor.

The external evaluation team will be composed of US and Cameroon experts in the areas of project evaluation and management/Agricultural Economics; Agronomy/Plant Breeding with special emphasis on Root and Tuber Crops; and Institutional Development and International Agricultural Development. The team will be multidisciplinary, but in order to minimize its size, preference will be given to individuals with dual expertise for example some one with additional back ground in Agriculture Economics will be/preferred. The project evaluation specialist will also serve as team leader. There will be a Cameroonian Counterpart with extensive knowledge of institutional and international agricultural development.

QUALIFICATION OF THE EXTERNAL TEAM MEMBERS

1. EVALUATION SPECIALIST

Expert with previous experience in project development, evaluation and management, graduate level training in Social Science/Agricultural Economics with considerable field experience in LDC, preferably in Coastal West Africa. Experience in Agricultural Development and knowledge of AID Management at the Mission level is desirable.

2. AGRONOMIST/PLANT BREEDER

Expert in Crop production with special emphasis o Plant Breeding. Graduate level training in Agronomy/Crop Science/Plant and Soil Science. Extensive knowledge in root and tuber crops is desirable. Although field experience is desirable this may be substituted for relevant experience in working with limited resource farmers or small scale agriculture programs in the U.S.

3. **INSTITUTIONAL DEVELOPMENT SPECIALIST**

Expert in Institutional Development with graduate level training in Social Science/Sociology/Agricultural Extension Education. Extensive knowledge of institutional development, Socio- Economic Development and Research and Educational Development in Cameroon is essential. Some knowledge of farming systems and extension education in Cameroon could be beneficial. Knowledge of Research and higher education structure and training needs is desirable.

4. **INSTITUTIONAL OBSERVERS**

Cooperating institutions are encouraged to send observers who may lend their expertise to the project and the evaluators as well as gain valuable experience in project evaluation and management. Costs for these observers are covered by their institutions (PSG funds or other).

VII REPORTING REQUIREMENTS

The format for the report should be in accordance with section 3.5.7 of AID Evaluation Handbook (April 1987 version) and shall include:.

a. Executive Summary
b. Project Identification Data Sheet.
c. Table of Contents.
d. Body of Report.
e. Appendixes.

The first draft of the report has to be completed by August 11, 1989 and final report submitted to USAID by August 21, 1989. The evaluation team leader is responsible for submitting the final revised evaluation report. He is also responsible for completing the abstract and narrative sections of the AID Evaluation Summary Form.

AID 1020-211-78

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Life of Project:
From FY _____ to FY _____
Total U. S. Funding _____
Date Prepared: _____

Project Title & Number: ROOT AND TUBER FOOD CROPS RESEARCH

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Program or Sector Goal: The broader objective to which this project contributes: Contribute to the improvement of Cameroon farmers socio-economic welfare through increased productivity of root and tuber crops.	Measures of Goal Achievement: 1. Increased productivity in root and tuber food crops. 2. Increased income of cooperating farmers.	1. Change in volume and quality of root and tuber food crops produced by cooperating farmers and reported in GRC statistics. 2. Partial Budget Analysis of cooperating farmers.	Assumptions for achieving goal targets: i. Availability of locally tested improved varieties of cassava, yam and cocoyam. ii. Favorable market conditions. iii. Stable or increase in demand for root and tuber crops. iv. Favorable weather, biotic and abiotic conditions. v. Favorable conditions. GRC continuous stress of Agric and Rural dev. as a priority in its dev. plans.
Project Purpose: Develop technically and economically feasible root and tuber rapid seed-stock multiplication technology for cassava, yam and cocoyam at project site.	Conditions that will indicate purpose has been achieved: End of project status. i. Effectively functionable seed-stock multiplication methods for cassava, yam and cocoyam at Ekona Research Center. ii. Self Sufficiency in high quality root and tuber seedstocks for the project site. iii. On-farm research testing of the root and tuber seedstock technique.	i. Volume of production of root & tuber seedstock at Ekona as presented in annual report of IRA. ii. Volume of improved seedstock at project site for on-farm research iii. Evaluation of farmers reaction to the on-farm testing of the developed technology	Assumptions for achieving purpose: i. Availability of tissue culture facility fully equipped. ii. Host country continued interest and commitment in the project. iii. Continued USAID commitment for duration of project.
Develop a resistant cocoyam variety against root rot and for other desirable agronomic characters through cytogenetic and breeding studies.	2. 1. Availability of improved cocoyam variety resistant to root rot and having desirable agronomic characters. 2. Self sufficiency in high quality material for rapid seedstock mulplication at Ekona.	1. Field test of developed variety against available germplasm, IRA and project reports 2. Volume of improved seedstock at project site, IRA and project reports.	2. Assumptions for achieving purpose: 1. Availability of Tissue Culture facility. 2. Continued AID/IRA support and commitment for duration of project.
1. Assess the state of the Technology on Root and Tuber Crop storage, processing and utilization.	3. Diagnostic survey of root and tuber producers, manufacturers/ processors and consumers.	3. 1. Survey Report and Recommendations 2. Original responses of survey instruments	3. 1. Cooperation from MOA's Extension Staff, and MIDEVIV Field 2. GRC's permission to conduct field interviews. 3. Cooperation from TLUs in the NCRE project.
Assist in the Institutional Development of IRA in Root and Tuber Crop Research.	4. 1. Completion of training for selected participants. 2. Equipped Tissue Culture and Agronomic Laboratory at Ekona Research Center.	4. 1. Number of participants under the project - project reports, IRA, reports. 2. Project and IRA reports on status of the laboratory. 3. Site visit.	4. 1. Release of candidates by GRC for training. 2. Availability of candidates with required qualifications for training. 3. Physical structur of Ekona to be renovated.

AID 1020-28 (11-72)

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Life of Project:
From FY _____ to FY _____
Total U. S. Funding _____
Date Prepared: _____

Project Title & Number: _____

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Outputs: 1. Economically feasible rapid root and tuber seedstock multiplication technology.	Magnitude of Outputs: 1. Capability of Ekona Research Center to Produce sufficient foundation seedstock of cassava, yam and cocoyam. Sufficient seedstock for on-farm testing. 2. Capability of Ekona Center to produce sufficient seedstock for on-farm testing. 3. Capability of Ekona Center to supply seedstock sufficient to cultivate 10% of land area used for the crops.	i. Volume of foundation seedstock produced at Ekona Research Center as stated in Annual Reports for on-farm testing and farmers use. ii. Analysis of yield, cost, profitability and agronomic desirability of crops produced by the developed technology - on-farm results.	Assumptions, for achieving output: 1. i. Continued support and functi of Ekona Research Center Fac ties. ii. Continued support and commitr of the five-year funding requirement from USAID/GRC. iii. Availability of land and Cooperating farmers.
2. Economically, agronomically and socially desirable cocoyam variety or cultivar for the agro-ecological zones of nature resistant to Root Rot Blight complex.	2. Capability of the Ekona Research Station to produce sufficient cultivars for rapid seedstock multiplication technology.	1. Field and laboratory test of improved cultivars. Reports of Lab, on-station, and on-farm testing of developed varieties that are resistant to Root Rot and Blight complex. 2. IRA Records.	1. Continued support and function Ekona Research Station. 2. Continued support and commitmen of personnel and facilities at Ekona Research Station. 3. Commitment of the five-year funding requirement from USAID/ 4. Access to reports/results of breeding work done by IITA and on cocoyam.
3. a. Constraints and opportunities in storage, processing and utilization of Root and Tuber Food Crops in Cameroon. b. Potential researchable problem to improve the storage, processing and utilization of Root and Tuber Food Crops.	1. Detailed analysis of the Root and Tuber Food Crop storage processing and utilization for the entire country. 2. Specific recommendations for on-farm storage, ~~processing~~ and utilization research needs on on Root and Tuber Food Crops.	Final Report of the Diagnostic Survey.	1. Continued support and commencem of Njombe Research Centre staff for the project. 2. Commitment of funding requiremer from USAID and GRC.
4. A. Six Cameroonians trained at the Graduate Level in USA. B. Short-term in-country and third country training courses conducted for 6 Cameroonians. C. Research Fellowships at U.S. Universities and Research Centers for 3 Cameroonians.	A. Four Cameroonians with Ms degree sponsored by the project. Two Cameroonians with Ph.D. under the project sponsorship. B. Successful completion of specified short-term in-country and 3 country workshop courses. C. Successful completion of three three Cameroonian fellows at U.S. Universities/Research Centers.	A. Certificates and transcripts from Universities. B. Certificates and Reports of training workshops. C. Communications/Reports from host Universities or centers. D. Project Reports.	1. Release of identified candidates for training by GRC: 2. Retentions of trainees in IRA.

AID 1020-2011-72

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Life of Project:
From FY _____ to FY _____
Total U. S. Funding _____
Date Prepared: _____

Project Title & Number: _____

INPUTS	MAGNITUDE OF INTPUTS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
I. AID	I. AID ($5,799,981)	1. UMES and IRA Annual Budget Reports	Assumptions for achieving goal targets:
1. Technical Assistance	1. Technical Assistance ($2,707,317	2. Project Annual Reports	Input Assumptions
2. Short Term Travel	2. Short Term Travel ($2,531,157		1. Availability of requested GRC counterpart personnel.
3. Language Training	3. Language Training ($ 70,000		2. Required funding will be prov on a timely basis._
4. Participant training	4. Participant Training ($ 443,000		3. Availability of Rental houses at Buea.
5. Commodities	5. Commodities ($4,851,343		
6. Recurrent Cost	6. Recurrent Costs ($ 606,572		
7. Other Costs	7. Other Cost ($ 341,321		
8. Contigency	8. Contigency ($ 527,271		
II. HOST COUNTRY	HOST COUNTRY ($2,069,980)		
1. Personnel	1. Personnel ($1,084,280)		
2. Utilities	2. Utilities ($6 67,197)		
3. Participant Training	3. Participants Trng. ($ 34,500)		
4. Laboratory Equipment	4. Laboratory Equip. ($ 135,485)		
5. Vehicle Maintenance & Transpotatio	5. Vehicle Maint. ($ 309,343)		
6. Offices and Furniture	6. Office & Furniture ($ 118,000)		
7. Land	7. Land ($ 100,000)		
8. In-country Travel	8. In-country Travel ($ 27,629)		
9. Contingency	9. Contingency ($ 187,644)		

59

APPENDIX C

PERSONS CONTACTED - ROTREP EVALUATION - 1989

USAID, WASHINGTON

Bonnie Pounce - Deputy Office Director - AID/W - AFR/CWA

Calvin Martin - Agricultural Officer - AID/W - AFR/TR/

Charles Morgan - Project Backstop Officer - AID/W - AFR/TR/ANR

UNIVERSITY OF MARYLAND EASTERN SHORE

Mortimer Neufville, Dean and Project Manager

C. D. Ignasias, Assistant Dean and Director for International Programs

Norman Anderson, Procurement Officer

William Hytche, President

Ronnie Holden, Vice President for Administrative Affairs

Edward Ellis, Vice President for Academic Affairs

Sharon Beyma, Project Accountant

Sarah Acquah, Project Coordinator

USAID, CAMEROON

Jay Johnson, Mission Director

John Balis, Agricultural and Rural Development Officer

Gary Cohen, Project Officer

Robert Shoemaker, Evaluation Officer

Brian Ames, Private Sector Development Officer and Macroeconomist

John Dorman, Assistant Agricultural and Rural Development Officer

70

MESIRES

H. E. Abdoulaye Babale, Minister of MESIRES

Roland Wandji, Director of Research, MESIRES

Joseph Ngalani, Chief of Studies and Assistant to the Minister, MESIRES

IRA, YAOUNDE

Jacob Ayuk-Takem, Director of IRA

NCRE

Thomas Stilwell - Assistant Chief of Party

EKONA

Honorable Maglorieduare Nguiamba, Governor, Southwest Province

Benjamin Nami, Delegate of Agriculture, to the Governor's Office Southwest Province

John Sonkeng, Economic Advisor, to the Governor, Southwest Province

Simon Lyonga, Chief, CNRCIP and Ekona Station (IRA)

John Nganga, Acting Chief, Ekona Station (IRA)

Samuel Nzietchueng, Chief Dschang Station (IRA), Acting Chief CNRCIP, ROTREP Plant Pathologist

Emmanuel Acquah, Chief of Party, ROTREP

Emilia Lifaka, Administrative Secretary, ROTREP

Paul Nganya, Stores Officer, ROTREP

Joseph Wutoh, Plant Breeder, Tissue Culturist, Root and Tuber Crops, ROTREP

Onghenekome Onokpise, Breeder, Geneticist, Root and Tuber Crops - ROTREP

Simon Zok, Agronomist, Tissue Culturist, " " " "

Xavier Ndzana, Agronomist, " " " "

Andre Nnoung, Agricultural Economist, " " " "

James Tambong, Agronomist, " " " "

Anne Sama, Senior Technician, " " " "

Leopold Nyochembeg, Senior Technician, " " " "

Mary Meboka, Senior Technician, " " " "

John Ngunge Lika, Field Technician, " " " "

James Kulu, Electrician, Ekona Station " " " "

Andrew Efema, Field Technician " " " "

Mathias Atelefack, Technician, " " " "

Thierry Talom, Technician, " " " "

Antoine Owona, Technician, " " " "

Anderson Njong, Technician " " " "

Simeon Siankam, Technician " " " "

Testing and Liaison Unit

Susan Almy, Socio-economist, NCRE, TLU

Tzegazeab Woldetatios, Agronomist, NCRE, TLU

C. Fri Ngundam Poubom, Extension Agronomist, NCRE, TLU

Manfred Besong, Agricultural Economist, NCRE, TLU

Ambe Comfort Ateh, Agronomist, NCRE, TLU

Mboussi Messia, Senior Technician, NCRE, TLU

Bonakanda Farmers

Njonge Molonge, Root Crop Farmer and Sub-Chief

Lyonga Effowe, Root Crop Farmer

Paul Ekema, Root Crop Farmer

Ndive Mbuse, Root Crop Farmer

Thomas Kinga, Root Crop Farmer

NJOMBE

Michael Foyet, Chief Njombe Station (IRA), Food Technologist

Abaka Whyte, Agronomist, GATSBY, IITA

Joseph Mpombi, Food Technologist, IRA

DSCHANG

Simon Lyonga, Director of ITA, UCD

Francois Kamajou, Deputy Director of ITA, UCD

Peter Hartman, Chief of Party, USAID Agricultural Education Project, UCD

Francois Mahop, Deputy Director of ENSA, UCD

Paul Mbouemboue, Plant Breeder, Department of Agriculture, UCD

Jean Nyemba Ambela, Extension, UCD

Cletus Asanga, Cereals Entomologist, IRA

Jones Monty, Rice Breeder, IRA

Joseph Tchatchoua, Cereals Pathologist, IRA

Charles Kouobou, Cereals Entomologist, IRA

Patrick Sama Lang, Soil Scientist, IRA

Jeremie Tchomtchoua, Root and Tuber Agronomist, IRA

Raymond Tchendji, Legume Agronomist, IRA

Pierre Ngameni, Root and Tuber Agronomist, IRA

APPENDIX D

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APPENDIX E

SHORT RESUME OF TEAM MEMBERS

Vernon C. Johnson is a graduate of Southern University, Baton Rouge, La. and the University of Wisconsin (Ph.D agricultural economics, 1954). He immediately undertook college teaching at North Carolina Agricultural and Technical State University, Greensboro. His work in A.I.D. commenced in 1957 in India as an agricultural program assistant. He was assigned to A.I.D's Africa Bureau in 1959 and remained with that Bureau until his retirement in 1979. During the interim he served as agricultural economist in USAID/Nigeria; as agricultural officer in charge A.I.D.'s agricultural program in the Western Region of Nigeria; as deputy director A.I.D.'s agricultural office in the Africa Bureau, Washington (1964-66); as a trainee at the National War College (1966-67); as deputy Director of USAID/Nigeria (1968-70); as Director of USAID/Uganda and USAID/Tanzania (1970-77), and finally as deputy assistant secretary in the Africa Bureau, Department of State (1977-79). Upon retirement in 1979 Johnson was employed by the office of International Cooperation and Development of the Department of Agriculture and subsequently by International Programs,

University of Maryland, College Park. Since 1986 Dr. Johnson has undertaken consultancies for UNDP, A.I.D., WINROCK and other development agencies.

Walter A. Hill is Dean, Research Director, Extension Administrator and Professor of Agronomy, School of Agriculture and Home Economics, Tuskegee University, Alabama. He was a visiting Scientist at Purdue University, (1982), Institute of Tropical Agriculture, Nigeria (1986), and the National Aeronautics and Space Administration (NASA) J.F. Kennedy Space Center (1987). He was the North American and European Councillor, International Society for Tropical Root Crops from 1985-1988 and is presently USDA/AID Scientific Liaison to the Asian Vegetable Research and Development Center, Taiwan. He is currently Project Director for root crop (sweet potato) research projects funded by USAID, USDA and NASA. His research has focused on nitrogen use efficiency of sweet potato cultivars developed for low-input cropping systems and production of sweet potato in controlled environmental life support systems for long-term space missions. He has published 80 research and technical journal articles, book chapters and paper presentations. He and his students have won several international and national awards for their research on sweet potato and yam. His education includes B.A., Lake Forest College; M.A.T., University of Chicago; M.S., University of Arizona and Ph.D., University

of Illinois. He currently serves on the Board of Trustees of Lake Forest College.

Francois TCHALA-ABINA is Professor of Rural Sociology, Chairman of the Curriculum Development Committee, and Director of the National Advanced School of Agriculture at the University Centre of Dschang, Cameroon. His education includes a degree of "Ingenieur Agronome", from the National Advanced School of Agriculture; M.Sc. and Ph.D from Cornell University, Ithaca, New-York. His research has focus on: agricultural development corporations, state-farmers relations and peasants organizations. He has served as consultant for USAID-Yaounde, the Food and Agricultural Organization (FAO) - Rome, the Centre for Integrated Rural Development for Africa (CIRDAFRICA)) - Arusha, the Centre for Education and Social Organization (CESO) - Amsterdam. He has visited several African countries on various assignments. He is a member of the Steering Committee of the West African Farming System Network (WASFARN). He has published about 30 research and technical papers, book chapters and mission reports. He is currently Deputy Mayor of Dschang.

Appendix F

ON-THE-JOB TRAINING UNDER ROTREP

	Name	Status	Field of Interest
1.	Anne Sama	Ing. Travaux	Plant Pathology Genetics Tissue Culture
2.	Xavier NDZANA	Ing. Agro.	Plant Breeding Genetics
3.	Andre Noung Mbassa	Ing. Agro.	Agric-Economics
4.	Charles Lyonga	Temp. worker	Agric-Economics
5.	Anderson Njong	Technician	Agric-Economics
6.	Simeon Siankam	Technician	Agric-Economics
7.	Mwambo Joan	Secretary	Computer Operation Telex Operation
8.	Ngum Perpetua	Typist	Computer Operation Telex Operation

Short-term and Long-term training under ROTREP

SHORT-TERM TRAINING

	Name	Status	Subject	Institution	Period
1.	Simon Zok	Tissue Culture	Tissue Culture Specialist	IITA, Ibadan	19-24/6, 1989
2.	Emilia Lifaka 9/7-11/8,		Admin. Asst.	Accounting, Personnel and U.M.E.S. Office Mgt, U.S.A. Computer Trg on Lotus 1,2,3 and D - Base III	1988

3.	James Kulu	GRC Elect. Instrumentation	Some major companies in USA where lab equipments were purchased and at UMES	2/15-5/20, 1989

LONG-TERM TRAINING

	Name	Degree	Subject	Institution	Period
1.	Tiky Mpondo	M.Sc.	Food Technology	Alabama A & M	6/88-1990
2.	Numfor Festus	Ph.D	Food Science	North Carolina State Univ.	9/88-5/92
3.	Xavier Ndzana	M.Sc.	Agronomy (Breeding)	Not yet determined	1/90-12/92
4.	Anne Sama	M.Sc.	Horticulture (Tissue Cult.)	Not yet determined	1/90-12/90
5.	Andre Noung Mbassa		Agric. Economy	Not yet determined	Not yet determined/

APPENDIX G

DATE OF ASSUMPTION OF DUTY OF CAMEROONIAN RESEARCHERS ASSIGNED TO ROTREP

No.	Name	Designation	Date of Assumption of Duty
	Researchers		
1.	Xavier Ndzana	Agronomist/Breeder	8 - 11 - 1986
2.	Anne Sama	Horticult/Pathologist	10 - 03 - 1987
3.	Tiky Mpondo	Food Proc./Biochem	June 1988
4.	Numfor	Food Proc./Prod. Dev.	Sept. 1988
5.	Simon Zok	Tissue Cult. Specialist	01 - 07 - 1988
6.	Nnoung a Mbassa	Ingenieur Agronome	13 - 02 - 1989
7.	Nyochembeng	ITA	12 - 01 - 1989
8.	Mary Boya	ITA	06 - 02 - 1989
9.	James Tambong	Ingenieur Agronome	23 - 01 - 1989

Appendix G

TRAINING OF STUDENTS UNDER ROTREP

A. From the University Center of Dschang

Name	Field of Interest	Period
1. Mary Boya	"Influence of some phytohormens on the sprouting time of minisetts of D. Rotundata and D. Dumetorum"	03/87-5/87
2. James Tambong	"A Preliminary Study of the development of Virus-free cassava by Tissue Culture."	02/88-0 5/88
3. Nyochembeng Leopold	"The Effect of different Media on regeneration of cultures of the white cultivar of cocoyam (Xanthosoma sag. L. Schott".	02/88-0 5/88
4. Tiky Manga	"The effects of selected hormones on dormacy and sprouting time of D. Rotundata"	02/88-0 5/88
5. Odelia Ngalla	Tissue Culture	02/88-05/89
6. William Nganje	Agric-Economics	1990
7. Faustin Epouche	Agric-Economics	1990
8. Tamanjong Motuba	Agric-Economics	1990
9. Jules Talom	Plant Production	1990

B. From Other Training Institutions

Name	Domain of Interest	Institutions	Period
1. Helen Tembu	"Production of Cocoyam minisetts".	T.S.C. Bambili	04/88-05/88
2. Sone Racheal	"The Economics of Ware Yam Production in Bonakanda Farming System: Tapping versus non Tapping Methods."	Abeenden University Scotland	07/88-09/88
3. Nana Sani	Tissue Culture	R.C.A.	03/89-04/89

Appendix H

PROPOSED ROTREP ECONOMIC PROGRAM

The role of economic studies in a research and development effort like ROTREP is to test for viability by seeing that the resources are allocated efficiently and that the potential users of the technology to be developed are an integral part of the process of developing the technology. For the private sector (i.e. farmers who use planting materials or investors who may produce seed materials through tissue culture), the packages to be produced should be economically rewarding. The producers of cassava, cocoyam and yams will exhibit effective demand for the improved planting materials from ROTREP if the returns of their investment are satisfactory. With the above perception in mind, the economics program in ROTREP has four foci namely: market price surveys, productivity Analysis of Root Crop Based on Cropping Systems, Economic Evaluation of Rapid Seed Multiplication Systems and Economics of the Breeding (See attached worksheets and diagram).

1. MARKET SURVEYS

The root crop market surveys collect market prices of Root and Tuber Crops in the study area, describe market practices in major markets where root and tuber crops are sold; the farming communities which serve such markets and consuming communities near these markets. The surveys are to be conducted through the remainder of this project phase in 1991, especially during the critical seasons of planting, growing and harvesting.

Information generated will serve as benchmarks for comparing root crop prices in the study area and will also be used to cross check responses from productivity analysis to be conducted in the future. The data will also be used for partial budget and sensitivity analyses for the technologies to be generated by ROTREP. Up until now, the study is focussed mainly in the Southwest Province with emphasis on Fako Division.

2. PRODUCTIVITY ANALYSIS OF ROOT CROP BASED FARMING SYSTEM

The purpose of this economic activity is to develop production function models for root-crop based farming systems in the study area and quantitatively assess the impact of production factors on output. Emphasis will be placed on capital with special attention to planting materials. The initial study will serve as a benchmark in determining the impact of the project in the future. It is expected to be completed by June 1990. A similar cross sectional study would be conducted after output from ROTREP has been adopted into the production system. Such an analysis will help to empirically determining the impact of the project.

The economics team has had several field visits to obtain secondary and some primarily data on root crop activities essential for the study. The instrument (questionnaire) to be used for the study has been developed and the field survey will be started in October/November of 1989.

3. INTERACTION WITH FARMERS IN THE COMMUNITY

The anticipated output from the rapid seedstock multiplication systems of the project is expected to provide an alternative seed yam source for the various farming systems.

However, the alternative system must be tested for its feasibility as an acceptable alternative to the current systems. In anticipation of this, the Economics team has initiated preliminary interactions with farmers in Bonakanda Farming Community. They are studying the implications of the combined system of ware yam production which includes seed yam production. The team has been working with 35 farmers since February 1988.

4. ECONOMICS OF RAPID MULTIPLICATION SYSTEMS

The economic studies will cover six stages for each of the crops (cocoyam, yam, and cassava). A resource flow format and procedure has been developed to generate/monitor data needed for these economics analyses.

a. Research and Development Cost

The analysis is focussed on the total cost of research and development of the technology up to the generation of planting material. It is therefore dependent on completion of the biological research works. As of now, only a study for cocoyam has been completed since the system for cocoyam is the only one developed so far. A similar exercise has been initiated for yam. Data collection started in July 1988. The analysis is expected to be completed by the end of January 1989. The system for cassava remains to be done.

b. Economics of Commercial Production

The activities include cost functions and derivation of average production cost per plant for each of the crops. The appropriate margin would be utilized to determine the expected price that farmers would eventually be charged per plantlet. The output of this exercise would be utilized to assess economic viability of private sector production of seed/planting materials and would also serve as input for on-station economic agronomic analysis.

Currently, data collection/monitoring has been initiated (started July 10, 1989) for cocoyam commercial production by tissue culture. For yam and cassava, it is expected that such analysis would be initiated by July 1990.

c. On-Station Economic-Agronomic Analysis

The on-station analyses will focus on partial budgeting, break even and sensitivity analyses. The analyses will be for both ex-ante and expost purposes. The outcome of the analyses would be used to determine future on-farm analyses. On-station analyses will begin after the rapid multiplication system has been developed. Based on the current status of the development of the rapid multiplication system, it is expected that the on-station analyses would start with the beginning of the 1991 production cycle for all three root crops.

d. Off-Farm Analysis

The output of the on-station analyses will be utilized to design on-farm analyses. It is expected that a minimum of two production seasons of on-farm trials would be necessary to develop recommendation packages for adoption. The perceptions and attitudes towards the use of the planting material that will be derived from tissue culture will be analyzed in conjunction with economic and agronomic variables to determine the feasibility of farmers acceptance of the new technology. The findings of the on-farm trials will be utilized to develop a package that can be recommended for adoption. These activities are expected to start in 1992. After the recommended package has been released to farmer, analyses of adoption will be conducted to ascertain the impact of the technology.

5. COCOYAM BREEDING ANALYSIS

The economic analyses will include on-station, on-farm and, subsequently; adoption analyses. However, no economic analyses can be initiated prior to the release of a variety that is tolerant or resistant to root rot. Given the status of development in the breeding program, the earliest optimistic on-station trials before wide-spread adoption can be recommended.

Emmanual Turkson Acquah

Appendix I

SOME LONG-TERM CONSIDERATIONS FOR AGRICULTURAL RESEARCH IN CAMEROON

A CONCEPTUAL NOTE

(EVALUATION TEAM FOR ROOTS AND TUBERS FOOD RESEARCH PROGRAM)

by

VERNON C. JOHNSON

BACKGROUND

Agricultural development in advanced countries has been accompanied by, and in fact resulted from, progress in technology which in turn is the product of research. Knowing this agricultural research is given high priority in U.S. aid programs. This is especially true in Cameroon and Africa generally. However, in spite of past research programs, agricultural productivity remains far below its potential.

One of the questions that should be asked is why hasn't research contributed more to development? Many answers undoubtedly would be forthcoming--insufficient numbers of trained scientists, too little investment in research, poor organization and management of research, need for general policy reform, weak institutional support, drought conditions and others. African countries have engaged in agricultural research through the colonial era and a few notable advances were achieved (Eicher, 1988). On the whole, however, results have been disappointing.

During the first 20 years after the wave of independence in Africa (1960-1980), bilateral donors financed a number of agricultural research projects. Meanwhile, other donors established International Agricultural Research Centers. These latter institutions, it was thought, would be able to introduce a mode of research in Africa similar to that which had fostered the "green revolution" in Asia.

A fair assessment of both ventures is that whereas the buildup of effort was noteworthy, the effects on agricultural production have been negligible. Obviously more thinking on this problem is required.

OBSERVATIONS AND FUTURE NEEDS

1. Need For A Change Image: The first observation toward change is conceptual--a need to view small farmers from a different perspective. Currently, they tend to be treated analytically as part of an indistinguishable mass when they should be treated as resource using farm managers and their farms should be treated as resource using farm managers, and their farms should be treated as small business enterprises. From this baseline, questions from the demand side would be whether agricultural research, as seen by small farmers, is cost effective and whether the risks are reasonable? Since most research to-date features purchased (and undoubtedly imported) inputs, risks during the early years of adoption could simply be too high to be assumed by Cameroon's small farmers.

If this perception is accepted, a job for agricultural researchers would be to combine accessible low-cost, yield-increasing local inputs with a minimum blend of inputs from outside. An essential such as commercial fertilizer is an example. But in order to hold costs down, green manuring, rotation of leguminous crops, recycling village wastes, recommended plant spacings, clean weeding, effective intercropping, more drought tolerant crops, better (and better care of) hand-tools and, where possible, traction to enhance labor productivity, and better water management in the North, would all be practices with low money costs, and they approximate simplified farm management research that was common in the U.S., during the early part of this century. Moreover, yields would be increased moderately at ever lower costs, while farmers are gradually testing more improved inputs.

2. A need to reexamine typical production units: If today one returned to most villages in Cameroon after, say, a 20 years absence, rather than higher and higher yields, he would more likely find continuing low yields and growing dependency. Although excellent weather may swell production in a particular year, the general picture of growth in production is from acreage increase in line with population growth. Traditional farming in Cameroon has become institutionalized in a way that tends to fragment land and it fixes farms at a size so small that production surpluses per farm remains low while a treadmill effect is created for farmers. Even if additional land is available, a combination of family hand labor and meager capital in the form of hand-tools becomes the limiting factor to higher productivity. This problem is especially actue at times of peak labor need such as weeding and land-clearing. If this perception is right, we have been focussing on the trees while ignoring the forest, i.e. the structural base of traditional farming itself.

Traditional farming in Cameroon presents a puzzle because being widespread over the entire country, private enterprises are too few and too restricted to service farmers. Small farms (and farmers) are spread too widely to be serviced adequately by government, donor assistance notwithstanding. Meanwhile, the farmers' small holding of about 1.7 ha. and other resources are too limited for effective self-help. What we have is a sort of equilibrium at a low level of production. Until there is a basic structural change in traditional farming itself this long standing and unrewarding condition will most likely persist.

We realize that Cameroon has put considerable interest in creating medium scale farms. This is the right direction, but the subsidies and credit for establishing them (EAMI Program) is too high and is beyond the financial capability of government (said to be $5,000 U.S. per ha.) (World Bank Agricultural Sector Review, March 1989).

Replication elsewhere will suffer. As disorganized as traditional farming may appear, we believe that with encouragement and minimal resources farmers themselves will make the necessary adjustments suggested in this paper.

CAMEROON APPROACHES

Throughout the colonial period, Cameroon followed the general pattern in Africa of focussing almost exclusively on export agricultural commodities at the expense of food crops. Since independence, the country has shown a marked increase interest in research on food crops and has established a rather elaborate research infrastructure of buildings, laboratories, and training (see our section on Institutions). A special Ministry of Higher Education, Computer Services and Scientific Research has been established and agriculture shares a large part of its budget in operating the Institute of Agricultural Research (IRA). Under the Institute, there are six research centers, and a multiple of stations and smaller research/units called antennas. The mission of IRA is to develop and carry out agricultural research programs in all branches of crop improvement, agronomy, and forestry (responsibility for livestock is elsewhere).

Recently (May 1989) IRA drafted an action plan for restructuring and reprogramming agricultural research in response to the economic crisis that is being felt. It involves a freeze of staff hiring, a reduction in some research elements (antennas), reduction in the number of research operations, and increased collaboration with donors. It is hoped that these changes can be had without a significant decrease in efficiency.

PERSISTING PROBLEM

During the ROTREP Evaluation, however, it was observed that in Cameroon, notwithstanding considerable past investment in food crops research, a persisting and frustrating problem has been the failure to research small farmers effectively. Since the vast majority of Cameroon's farmers are in this category, it underlines the point that unless we can solve the problem of small farmer participation and opportunity, we are not likely to increase the country's agricultural production and income significantly. The remainder of this Appendix discusses future research needs within the context of the small farmer's plight.

FARM ENTERPRISES

Whereas only a few farms were visited during the ROTREP Evaluation, it is a safe assumption that many other similar ones exist. These farmers were cultivating about one acre, but certainly not more than one hectare of land under mixed crops. Even with these small farms, capital is so meager that some farmers took the unusual practice of hiring labor for such jobs as land clearing, and soil preparation for planting. Yams seemed to be the principal crop (under care of men) but cassava and especially cocoyams are in the crop mixture complemented by pepper, bananas, plantains, sweet yams and pumpkins. In addition to the plot currently being cultivated, a farmer would own at least one other plot to which he shifts when his yield begins to decline. As seen by these farmers, this traditional practice of shifting cultivation eliminates the use of commercial fertilizer which, in any case, they claim is too expensive.

While wives may assist their husbands with some tasks such as harvesting, they and their children have full responsibility for their own separate farm with a first obligation to provide food for the family and from which they

sell small quantities throughout the year. This keeps a small income stream lots to meet such obligations as school fees.

These farmers listed their priority problems as: 1) high marketing costs (especially transport) in face of low market price, 2) yam beetles, and 3) high labor costs. Their capital is limited mainly to hand-tools, they suffer post harvest losses from poor storage, and although the root crops they produce (e.g. cassava) can be prepared many (reportedly 19) ways, only limited value is added. However, the farmers are aware that research is being conducted at Ekona and are anxious to experiment with improved varieties, if any, when available.

The clear impression one gets is that these traditional farmers, for the most part, are following the footsteps of their ancestors, and it would appear fair to ask whether it is realistic to assume that growth from agriculture will come rapidly or soon when the standard farm size among the vast majority of Cameroon's farmers is less than a hectare of land under cultivation, and their capital consists mainly of a few hand-tools. How then can growth and development given the nature of traditional farming in Africa?

SOME INDICATORS

Twenty-five years ago when writing about similar traditional farmers, T. W. Schultz observed that the plight of small farmers is not a question of inefficiency. They pinch every penny and on any economic allocative test they are indeed more efficient than more abundantly endowed farmers. Thus, exhorting them toward a better allocation of resources from limited resources at their disposal is not likely to be rewarding.

When it comes to investment as a means of increasing agricultural production, farmers who practice traditional farming have in general exhausted all profitable opportunities, given the resources at their disposal. In practical terms, this means that adding another customary hoe or axe will increase production very little at the margin. Piling them on would yield an unattractive rate of return. Thus, investment is extremely limited and for good economic reasons.

The economic evidence would seem to indicate that in order to generate growth from agriculture in Cameroon, small farmers must be able to obtain and use resources beyond those available from their traditional sources of supply, and one element of such resources must be those that assist and encourage larger land holdings (farms). We have mentioned that try as they may, African governments, including Cameroon, cannot service farmers effectively spread as they are over the country, nor can the farmer do much himself under the limited investment opportunity available to him.

In the future, agricultural research in Africa therefore, cannot continue to ignore land and farm management problems--land capability, land use, and land tenure, soil conservation and, particularly, how to increase the productive capacity of individual farms. Farmers with incentive for change need to know how they can move their farms from the present one acre under cultivation to five acres, on to ten acres, and eventually to 50 acres or more. At present, neither the available technology nor the institutional/legal structures for acquiring and holding land give encouragement to this prospect. In fact, small garden-type farms are treated analytically as given. If one were to ask questions and propose long-term change in the very structure of traditional farming, the responses most likely would be: 1) that small farms do well in Asia, why not Africa?

Or, 2) that acre for acre small farms yield higher than large farms, and 3) that no alternative employment opportunities exist for present farm labor, thus, the only realistic option is to raise productivity and income on present small farms.

Our comments to such responses are provided in reverse order. First, migration from farms already is an on-going and accelerating occurrence and is common to agricultural development in general. A declining farm population and increasing agricultural productivity go hand-in-hand. Why must Africa be different? Also, wage employment on private commercial farms in Africa already is considerable in a few countries (Zimbabwe, Kenya, Ivory Coast) and could more generally become an alternative source of income in Cameroon. Moreover, much of Cameroon's arable land at any given point in time is in bush fallow. If research could replace these fallow lands with repetitive cropping, new cultivated areas would open up and active farms could become much larger. Second, whereas higher yield per acre on small farms does apply in may countries, it does not, as a general rule, apply in Sub-Saharan Africa. Privately operated medium to larger commercial farms consistently perform better than small traditional farms or large parastatal farms. This is true whether under European, or African management, or whether in the Kenya highlands, Zimbabwe, Zambia or Ivory Coast. The most successful farmers in Africa are those with private holdings of commercial scale and who are best able to help themselves. Finally, to compare small farms in Cameroon with small Asian farms is unrealistic. For the latter, the soil is more fertile, cropping is a different mix and far more intensive, irrigation water is available over wide areas, and private and government support is stronger. If research can lead to more productive farms, the commodities to be produced and research priorities for the future could be determined in large part by market price.

3. Need for Research on Processing, Food Technology, Utilization and Expanded Markets: Two final areas of future agricultural research should be mentioned. Host African countries and donors have been so obsessed with primary production to an extent that ways to add value to this production, to look into other factors on the demand side, and to expand markets have been ignored. Growth from agriculture will not occur unless our thinking is revised. Cameroon, for example, has been growing cassava for decades and has been trading with Europe for decades, yet it is Thailand and Indonesia, not Cameroon that supplies a huge European market with cassava for livestock feed.

Root crops and maize are grown widely in Cameroon, but they usually undergo only limited process changes--grinding, pounding before being consumed directly as human food. Thus, little employment or income are generated. In the U.S., on the other hand, maize is processed into numerous commodities (cereals, fuel, starch, animal feed, syrup, etc.) and each derived product stretches demand and generates employment and income. Finally, research on market expansion is a pressing need in Cameroon starting with the domestic market, spilling over to the regional market, and then to international markets. It is noted, for example, that most African countries tend to produce identical crops. This is dictated to an extent by physical and climatic condition and by taste preferences developed over time. It is equally true, however, that trade and maximum production are curtailed in the absence of more specialization and exchange between countries. More research to utilize comparative advantage and trade among African countries would be a step in the right direction. The OAU might give some attention to this prospect.

SUMMARY

Before the 1960's, research assistance, by and large, was by way of resource transfer from colonial powers, and later from donors to Africa. Small farmers benefitted only marginally. Our need now is for major new and useful approaches designed to stimulate production and energize farming which, unitl now, remains traditional.

Thrust of this short conceptual paper is to suggest that an over-arching agricultural research problem for the future lies in undoing the rigidity of traditional farming itself institutionally, legally, and technically. Traditional farmers find themselves on an economic treadmill. They are unable to accumulate their own growth capital and are too numerous and too widespread to be assisted effectively by weak governments. Donors have equal difficulty. However, analyses into economies of scale as they apply to Africa are rarely suggested, and if one questions the economy of small farms, he is charged with promoting "large-scale mechanized farms". The need, to repeat, is neither garden size farms nor large parastatal farms, but rather rational commercial farms with open access to land, modernized tenure practices, and accelerated research on farm management designed for family and commercial operations. Unless African governments make real structural changes, a focus of policy, especially with regard to scale of operations, the growth objective will continue to be elusive. This, as we see it, is a major challenge to future research and policy planners.

102

Appendix J

Unresolved Issues/Questions To Be Considered in Future Research and Proposal Development

Technical and Scientific

1. A major problem affecting marketability of yams identified by the farmers of Bonakanda was beetle damage of mature tubers. Insecticides are available but are very costly for small farmers.

2. Development of routine indexing procedures that ensure virus-free cassava for tissue culture multiplication are needed.

3. The technical feasibility of root crops as an animal and fish feed has yet to be explored.

4. What is the role of an improved cultivar in a multi-variety (security based) mixed cropping system?

5. There is a need to evaluate an improved cultivar's ability to compete with weeds and ability to grow on specific soils in different cropping systems.

6. The Evaluation Team found nothing that would eliminate drying as a means of prolonging shelf-life of fresh cassava. Removal of cyanide is a major problem.

7. Should processing cassava leaves be considered?

8. Why is there no emphasis on Taro research?

9. What is the implication of the worms found in cocoyam in the Southwest and Littoral Provinces?

10. What will be the strategy if in the long run resistant yellow type cocoyam cannot be crossed with progeny of the red and white type cocoyams?

11. How significant is the preliminary finding that tissue culture derived plants flowered 20 to 30 days earlier than normal; will this be a consistent phenomenon?

12. How significant is the preliminary finding that multiple suckers develop on tissue culture derived plants and one sucker develops from traditional seed stock?

13. What are the optimum, most efficient time and conditions for acclimatization of tissue culture plants prior to planting in the field?

14. Agronomic studies are essential in a second phase; focus needs to be on soils, location, cropping system basis. Perhaps selection and breeding should take place in the different agro-ecological zones.

15. Cocoyam is a shade tolerant plant and may be useful in preventing soil erosion.

16. The present cassava multiplication procedures used by GATSBY are not efficient enough to reach most farmers; no farmers in the South, Eastern or Central Provinces are being serviced by GATSBY.

Economic and Social

1. There is a need to improve methods for measuring root crop production given the local consumption of produced crops.

2. It is important to not let donors decide on research priorities, e.g., whether or not cocoyam is worth a serious research effort; people whose staple crop has been cocoyam are having difficulty adjusting gari.

3. What will be the effect of increasing production of one root crop on production of another?

4. It is important to understand who delivers technology and who uses it, i.e., how it is transformed in the home.

5. Market studies are needed for processed root and tuber crops in Central Africa and Europe.

6. Contradictions in root and tuber crop production trends were apparent in the ROTREP Diagnostic Survey and the IRA 1988 production data.

7. The economic feasibility of root crops as an animal and fish feed should be explored.

Institutional

1. What will be the relationship between the University of Ngaoundere, Food Technology Program and the Food Technology Laboratory at Njombe when it is operational.

2. What will be the relationship between ROTREP and the various extension services when mass production of improved planting materials starts?

104

Appendix K

REPORT ON STRATEGY FOR COCOYAM (*Xanthosoma sagittifolium, l.* Schott) BREEDING

BY:

DR. JOSEPH G. WUTOH

July, 1989

ROTREP

STRATEGY FOR COCOYAM (*Xanthosoma sagittifolium*, L. Schott) BREEDING

DR. JOSEPH WUTOH

SUMMARY

A breeding strategy for developing resistant or disease tolerant cocoyam has been outlined. It utilizes three ways to produce moderately resistant clones from (1) clonal selection are (2) Hybridization at the diploid of susceptible "white" and moderately resistant red cultivars, and (3) Hybridization of susceptible "white" variety and highly resistant yellow polyploid.

Partial dialle crosses are suggested in the hybridization processes so as to predict specific and general combining for ability parameters and to shorten the clonal selection process. In the first instance (clonal selection) a new cultivar will be released in 1993 through the technology of rapid seed multiplication system (Tissue culture); in the second (diploid hybridization) instance a new cocoyam cultivar or variety will be released in 1994 also through the technology of tissue culture and thirdly, by the polyploid hybridization and selection, a new variety will be released in 1997 through Tissue Culture technology of selected clones.

By the proposed strategy, a moderately resistant or tolerant cocoyam will reach the Cameroon farmer by 1993 and be replaced through stages by a highly resistant clone in 1997.

INTRODUCTION:

The root rot disease of cocoyam - macabo (*Xanthosoma sagittifolium* (L), Schott) caused by the fungus *Phythium myriotylum* has been a major constraint in cocoyam production in Cameroon. (Nzietchueng 1985).

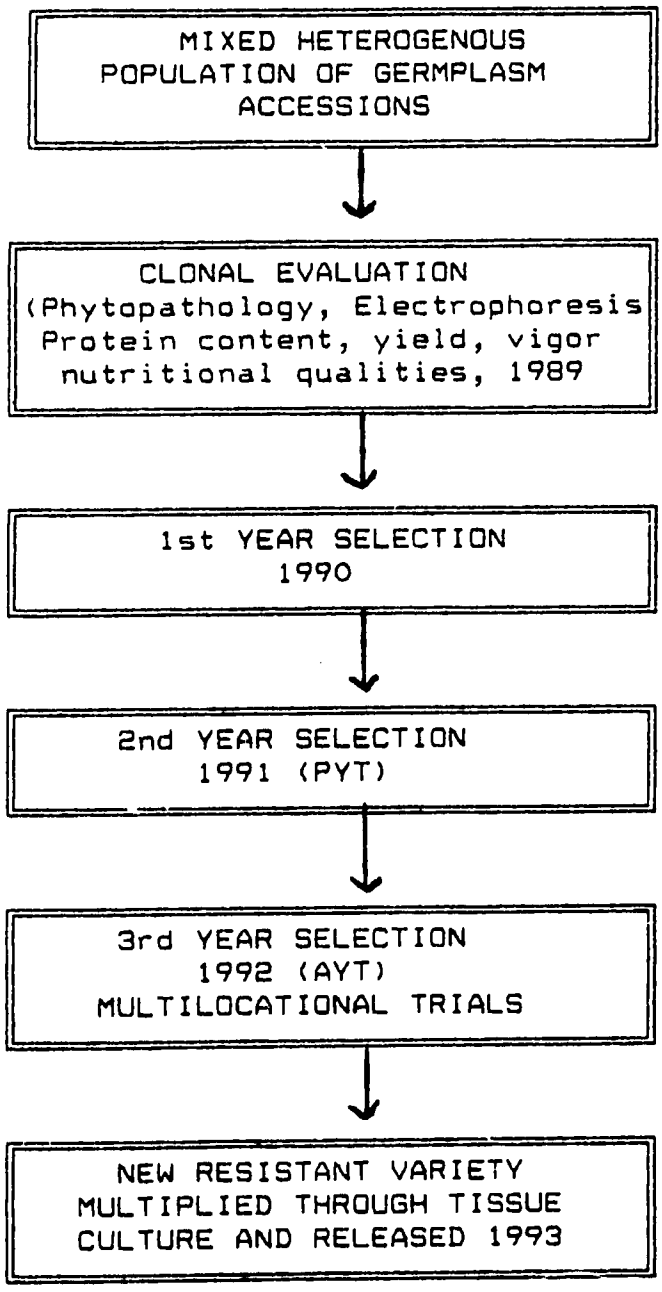
107

According to available data from the Provincial Delegations of Agriculture in the cocoyam growing areas, there has been a dramatic drop in yield from 1,812,422 5ons in 1976/77 to 763,501 tons in 1980/81. The decline in yield is still not arrested and vast areas of macabo are now being replaced by taro or other crops (Lyonga and Nzietchueng, 1987; Adams et al; 1988). A major goal of the ROTREP program deals with a plan to develop a commercially acceptable cocoyam resistant to the root rot disease of the three known varieties of cocoyam in Cameroon ("white", red and yellow), the white which is the most prolific and heaviest yielder and the most preferred, has been the most susceptible to the root rot disease; the red is tolerant to the disease but is less preferred; and the yellow, which shows maximum resistance to the disease, produces only rudimentary cormels and is of no commercial importance. In order to accomplish the breeding objective of ROTREP, a cocoyam breeding strategy has been developed based on the nature of the agronomy of the cocoyam varieties and the expected benefits to be derived from a root rot free cocoyam in Cameroon.

The "white" and red varieties of the Cameroon cocoyam are diploid (2n=26) and the yellow is a polyploidy, probably a tetraploid with 4n=52. It has not been possible to make successful crosses between the diploids and the yellow polyploid, and, therefore; a possible breeding method involving the two types will utilize polyploidization of the diploid before hybridization with the yellow; currently the floral morphology and development is being studied and the chromosome numbers are to be confirmed.

CHART I

A. CLONAL SELECTION



101

CHART II

B. **HYBRIDIZATION OF "WHITE" AND RED VARIETIES FOLLOWED BY SELECTION AND RELEASE OF CLONES IN 1994**

GERMPLASM MATERIALS ESTABLISHED IN SOURCE NURSERY AND MAINTAINED 1987/89. PARENT SELECTED

↓

FLOWER INDUCTION DIALLED CROSS INVOLVING "WHITE" AND RED SELECTED PARENTS (1989)

↓

1ST YEAR (F_1) SELECTION AGAINST ROOT ROT AND OTHER CHARACTERS. GENERAL AND SPECIFIC COMBINING ABILITY DETERMINATION AND GENETIC ESTIMATES AND EARLY PREDICTION OF PARENTAL PERFORMANCE 1990

↓

2ND YEAR CLONAL SELECTION EVALUATION 1991

↓

PYT AND AYT EVALUATION IN MULTILOCATIONS 1992, 1993, 1994

↓

TISSUE CULTURE APPLICATION FOR MASS RAPID MULTIPLICATION AND RELEASE 1995

C. **HYBRIDIZATION OF AUTO POLYPLOID "WHITE" AND RED COCOYAM VARIETIES WITH POLYPLOID YELLOW FOLLOWED BY SELECTION AND RELEASE IN 1977**

GERMPLASM MATERIALS ESTABLISHED IN SOURCE NURSERY AND MAINTAINED. 1987/89. PARENTS SELECTED AS A RESULT OF EVALUATION AND POLYPLODIZATION ACHIEVED CYTOGENETIC STUDIES

↓

FLOWER INDUCTION. PARTIAL DIALLED CROSS INVOLVING ARTIFICIAL "WHITE" AND POLYPLOIDS, AND YELLOW 1990

↓

1ST YEAR (F_1) SELECTED AGAINST ROOT ROT, FOR OTHER AGRONOMIC CHARACTERS. DETERMINING GENERAL AND SPECIFIC COMBINING ABILITIES AND OTHER GENERAL ESTIMATES; EARLY PREDICATION OF PARENTAL PERFORMANCE 1991

↓

2ND YEAR CLONAL SELECTION
1992
(POSSIBLE BACKCROSSED AND SELECTION)

↓

3RD YEARS CLONAL SELECTION
AND 4TH 1993, 1994
(POSSIBLE BACKCROSSES AND SELECTION)

↓

PYT AND AYT EVALUATION IN MULTIPLICATIONS AND SELECTION 1995, 1996.

↓

TISSUE CULTURE APPLICATION FOR MASS RAPID MULTIPLICATION AND RELEASE 1997.

THE HYBRIDIZATION PROGRAM

Two parallel studies are proposed in a hybridization program involving (1) the "white" and red diploids so as to transfer the moderately resistant or tolerant gene in the red to the "white" in a partial dialled cross (Chart II); (2) production of polyploids from the diploid "white" and red varieties and crossing them to the resistant polyploid yellow in a partial dialled cross (Chart III). In both cases, it will be possible to determine the genetic estimates (specific and general combining abilities and make early genetic predictions of the parental performances.

In the case of the diploid red and "white" crosses (Chart II) selection against root rot and other characters will begin with the F1 and any heterosis observed will be noted (1990). In 1991, 1992 and 1993, clonal selection will be followed by preliminary and advanced yield tests and disease screening in multilocations.

When a clone is selected for its desirability, it will be subjected to tissue culture methodologies for mass rapid multiplication and released after some field testing in 1994.

In the hybridization of polyploid red and "white:, the parents selected as a result of germplasm evaluation (phytopathology, protein content, electrophoresis, etc.) will have their chromosomes doubled so as to create polyploids which can easily hybridize with the polyploid yellow. It will be necessary to do some further cytogenetic studies to determine the effect of the colchicine solution (0.4%, 0.8%) of the plants.

112

In 1990, these polyploids will be induced to flower and diallel (partial) cross performed. In 1991, selection against the root rot disease and for some desirable agronomic characters will be undertaken. In 1992, clonal selection with the possibility of back crossing followed by selection will be done. This will be repeated in 1993 and 1994 with preliminary and advanced yield and other trials conducted in 1995 and 1996. Any desirable clones selected will be subjected to tissue culture procedures for mass production of seedlings for release to farmers.

TISSUE CULTURE APPLICATION

In the event of difficulties in hybridizing the red and "white" autopolyploid with the natural polyploid yellow, protoplast fusion may become necessary as a means of hybridization to overcome the problem of a possible incompatibility.

COMMERCIAL PRODUCTION

A. SUBSTITUTE ITEMS OF EQUIPMENT

1.	Autoclave/sterilizer ($25,000):	Household pressure Cooker ($50)
2.	Walk-in environment Chamber : ($45,000)	Locally constructed Lighted room ($50)
3.	Glassware ($26,000):	Glassware ($5,000)
4.	Laminar Flow Hood ($10,000):	Sterile Bench ($2,000)
5.	Phytagar ($15,000):	Corn agar ($150)

Will experiment on in phase II

(b) Chemicals: These will remain the same and most can be purchased locally. The few additives (hormones, auxins) can be ordered. A good source of distilled water will be necessary.

(c) Technical Labor: It is possible (as has already been demonstrated at the ROTREP Laboratory) to train a primary school leaving certificated person to achieve the level of excellence in yam tissue culture methodology. Training time is one (1) week.

Such a proposed commercialization scheme is vital for the success of the research program and has to be experimented as part of any second phase project operation so as to include this aspect in a complete package to the government of Cameroon.

In it s implementation, the low cost equipment items and chemicals together will low cost technical personnel need to be combined in a smooth flowing operation from preparation of yam explants through acclimatization and field tests to be the production of ware yams.

SCOPE OF WORK

I. PROJECT IDENTIFICATION DATA

1. **COUNTRY: CAMEROON**

2. **PROJECT TITLE:** ROOT AND TUBER FOOD CROPS RESEARCH IN CAMEROON.

3. **PROJECT NUMBER:** 631 0058

4. **PROJECT DATES:**
   a. Cooperative Agreement: August 29, 1986
   b. Final Obligation Date
   c. Grant Agreement Amendment 1:
   d. Grant Agreement Amendment 2:
   e. Grant Agreement Amendment 3:
   f. Original Project Assistance Completion Date: August 29, 1991.

5. **PROJECT FUNDING ($ MILLIONS):**

a.	AID Bilateral Funds:	$5.7
b.	Cameroon Counterpart Funds:	$2.1
	TOTAL	$7.8

6. **MODE OF IMPLEMENTATION:**

AID Bilateral: Cooperative Agreement with University of Maryland Eastern Shore as lead institution with sub-agreements with Alabama A & M and Florida A & M Universities.

Republic of Cameroon Government (GRC): Protocol Agreement between GRC and the three collaborating universities.

7. **PROJECT DESIGNERS:**

- University of Maryland Eastern Shore (UMES), Alabama A & M (AAMU) and Florida A & M University (FAMU).
- GRC Officials
- Mission Staff.

115

8. **RESPONSIBLE MISSION OFFICIALS:**

a. Mission Director: Jay Johnson, 1986 - Present
b. Project Officers: William Judy, 1986 - 1987
Gary Cohen , 1987 - Present

9. Previous Evaluations: None.

II. PURPOSE OF MID-TERM EVALUATION

The primary purpose of the mid-term evaluation is to constructively review the management and technical aspects of the Root and Tuber Food Crops Research Project, and make recommendations to facilitate the ultimate achievement of the overall project purpose.

The evaluation will assess the administrative and technical aspects of the project in terms of overall organization, relevance, effectiveness, impact and efficiency and determine the likelihood of accomplishing the expected project outputs by the project completion date. The expected outcome of the evaluation is a detailed report which specifies project strengths and weaknesses, identifies its problem areas, and recommends specific actions necessary to strengthen and improve the planning, execution and monitoring of the components.

The evaluation report will also identify future project directions, and outline the specific activities which will facilitate the implementation of future directions.

The evaluation should be an impact evaluation, offering constructive criticism both to the project implementors and the respective providers of inputs.

III. **BACKGROUND**

The three collaborating universities AAMU, FAMU and UMES have been active participants in the USAID Title XII strengthening grant programme. As an outcome of their involvement in the strengthening grant program, the three 1890 Land Grant Universities decided to form an informal consortium to solicit funds from USAID to help address some of the unique agricultural problems of sub-sahara Africa. In December 1983, the group submitted an unsolicited proposal entitled "Tropical Legume Germplasm Center: Collection, Conservation and Utilization" to USAID, Washington for review and possible funding. In response to this original proposal, a planning grant was approved by USAID for Scientists from the three participating institutions to visit West and Central Africa, to gather additional information relevant to the needs of LDC's in sub-saharan Africa. The additional information was to enable us to better understand the agricultural problems in the areas visited to refocus on priority problem areas.

On October 21, 1984, the collaborating universities submitted a report on their USAID sponsored visits to Senegal, Liberia, Ethiopia, Niger, Cameroon, Nigeria, Rome(UN-FAO) and London (Tropical Development and Research Center). The report identified a number of general and specific concerns, problems and constraints in agricultural production with recommended action.

On January 15, 1985, the three universities submitted another proposal entitled "The Development of Under-exploited Tropical Legumes, Root and Tuber Crops to improve small Farm Productivity and Nutritional Status in selected countries in Sub-Sahara Africa", to USAID Washington for consideration. Subsequently the three universities were requested to narrow the focus of the project to a single country instead of the original regional concept.

On December 20, 1985 another proposal entitled "Seed stock Multiplication and Post Harvest Processing of Yam and Sweet Patoto in Cameroon" was submitted to USAID, Washington for consideration. The proposal received high interest in GRC and USAID Yaounde and consequently the group was requested by USAID to send a team to work with GRC to jointly revise the proposal to meet other root crop specific needs of Cameroon. In May 1986, a jointly revised proposal entitled "Root and Tuber Food Crops Research in Cameroon" was submitted to USAID and GRC for consideration.

The revised joint proposal was comprehensive and included Breeding, Rapid Seedstock Multiplication System, Storage, Processing, Utilization and Institutional Development. Because of financial constraints the review committee which consisted of representatives from USAID, GRC and the consortium of the three universities decided that:

(a) The food technology component of the project (Storage, processing and utilization) should be deleted in order to meet the 5.8 million dollar budget limitation.

(b) One of the major outputs of the project should be a study of the nature and magnitude of post harvest losses of root and tuber food crops, the PROCESSING and UTILIZATION constraints of root and tuber crops systems and to recommend researchable problems and opportunities for improving the system.

(c) The recommendation from the report of the survey on Post Harvest Losses, Processing and Utilization should be reviewed and given serious consideration for funding by GRC and USAID given the high interest that GRC had in the topic.

(d) The human resource development component of the food technology section of the project (1 Ph.D in Food Technology with concentration in Biochemistry, and 1 M.Sc in Food Technology with emphasis in product development) should be retained in the scaled down project in anticipation of future add-on of the total food technology component of the project. That such a strategy will enable IRA to have a core of researchers to effectively participate in the anticipated research areas in food technology.

(e) Complete deletion of the food technology component of the study had serious technical and political implications for IRA.

The goal of the approved proposal is to contribute to the improvement of Cameroon farmers' socio-economic welfare through increased productivity of root and tuber food crops. The objectives of the project are to:

(a) Develop locally acceptable variety of cocoyam which is resistant to Root Rot Disease.

(b) Develop feasible (technical and economical) Seedstock Multiplication System(s) for yam, cassava and cocoyam.

(c) Study the nature and magnitude of post harvest losses of root and tuber food crops systems and recommend researchable problems and opportunities for improving the system(s).

(d) Assist in the Institutional Development (Human and Physical) of the Institute of Agronomic Research in Root and Tuber Food Crops Research.

The project is implemented by the University of Maryland Eastern Shore (as Lead Institution) Alabama A & M University, Florida A & M University and the Institute of Agronomic Research in Cameroon. The field head office for the project is located at the IRA Ekona Research Center. Its on-station research activities are concentrated at IRA Research Centers at Ekona and Njombe. The on-farm research activities of the project will cover Agro-ecological Zones I and II which encompasses the North-West, West, South West and Littoral Provinces of Cameroon. As of May, 1989, USAID had done three project implementation Reports (PIR) for the project.

IV. STATEMENT OF WORK

Prior to the field visit the prime contractor shall provide the US based evaluation team members with relevant resource materials so that they may become familiar with the goals and purposes of the project.

Guidance and direction during the evaluation will be provided by USAID Cameroon. Under the supervision of the Team Leader with the assistance of the Project Manager, the Director of IRA and the Chief of Party, the team shall address the following questions:

A. TECHNICAL ASSISTANCE

1. What are the major project accomplishments to date and are activities on track vis a vis the work plan in the Cooperative Agreement?.

2. Given the progress/accomplishments made to date what is the likelihood that the following outputs will be achieved by 1991?

   (a) Develop locally acceptable variety of cocoyam resistant to root rot and blight complex.

   (b) Develop feasible (technical and economical) yam, cassava and cocoyam rapid seed stock multiplication system.

   (c) A survey report with identification of researchable problems relating to post harvest losses of root and tuber food crops and recommend opportunities for improving storage, processing and utilization.

   (d) Assist in the institutional development of IRA in root and tuber food crops research.

3. Given the report on output (2c) above and other reports, assess the need for research in processing, transformation and utilization of root and tuber food crops in Cameroon?

4. Are the assumptions on which the project design was based still considered valid?

5. Is the overall project design considered both valid and appropriate in the present context?

6. Is the technical staff adequate and appropriate to accomplish the project purpose?

7. What are the major adjustments needed in the scope of work for the project to accomplish its purposes?

8. Are there similarities, redundancies, gaps and or complimentarities with activities being undertaken by ROTREP and the activities of other projects of the CNRCIP (i.e. IITA, GATSBY Foundation, CIP etc)?

9. What are the major technical constraints to date in implementing the project and how can they best be resolved?

10. What are the Social, Political and Economic benefits to be derived from this project (include public awareness)?

11. Assess the adequacy of proposed Economic analysis to determine potential benefits from the project?

16

B. PROJECT MANAGEMENT AND ADMINISTRATION

1. What is the grantee's management capability. commitment and overall performance in implementing the project? i.e. Long term personnel utilized, tenure track personnel, home campus administrative commitment, budget and financial management, commodity procurement process, storage, distribution and resupply systems.

2. How is the management of the project integrated into the IRA System?.

3. Is the Executive Committee concept of Project Management as practiced in ROTREP effective vis-a vis. traditional USAID management style?.

4. Have relationships and linkages been developed with other AID funded projects, other domestic and international institutions?.

5. How appropriate is the project field administrative structure?. Are staff members adequate and appropriate for assigned tasks?.

C. TRAINING

1. Have the training activities been conducted according to plan?

2. Are the allocated longterm and shortterm training slots adequate to support and sustain root and tuber food crops research in Cameroon?.

3. Are there constraints in training, and how may they be alleviated?

D. FINANCIAL MANAGEMENT AND CONTROL

1. Is the funding (USAID and GRC) level adequate to accomplish the project purposes?

2. Does the financial management system provide adequate control of working fund, reconciliation of funds, financial record keeping system etc?.

3. Is the GRC contribution in line with USAID expectations?

4. Given the current financial crisis, what are the prospects for both financial and institutional sustainability of the project activities after the completion of USAID assistance (particular attention should be focused on GRC/IRA's capacity to operate, maintain, repair and replace the project facilities at Ekona Research Centre)?.

5. Are there major constraint in financial management?

E. GENERAL

1. What is the relevance of the project in the hierarchy of agricultural research prioritization in IRA?.
2. Are there any unanticipated benefits from the project?.
3. What are the major issues to be addressed by USAID, MESIRES/IRA and or the cooperating Land grant universities?.
4. Assess those aspects of IRA procedures, rules and regulations which have a bearing on the operation at Ekona and their implications for the long term efficiency of the ROTREP Laboratories.

5. Assess the adequacy of mechanism for establishing policy, priorities and resource allocation, formulation of objectives and monitoring/evaluation of the ROTREP activities?.

V. METHODS AND PROCEDURES

The entire evaluation process is expected to take three weeks to complete; with a six (6) day work week. The evaluation will start on July 26 with a two day orientation/observation at the project office at UMES and one day orientation at USAID/Yaounde. The team will spend about one week visiting and observing project activities in the field.

The primarily sources of information for the team will be existing written information (Project documents, Reports, Papers, etc). Interviews with project staff, USAID staff and GRC Officials through rapid reconnaissance method will be essential.

The team will provide a first draft of their report for USAID/GRC/Grantee comments and make the revision if necessary in the field. The team is expected to have a nearly final form of its report before departing for USA. The submission of the final report is expected within two weeks after departure from Cameroon.

VI. EVALUATION TEAM COMPOSITION

The project evaluation is a joint effort between USAID, GRC and the Contractor.

The external evaluation team will be composed of US and Cameroon experts in the areas of project evaluation and management/Agricultural Economics; Agronomy/Plant Breeding with special emphasis on Root and Tuber Crops; and Institutional Development and International Agricultural Development. The team

will be multidisciplinary, but in order to minimize its size, preference will be given to individuals with dual expertise for example some one with additional back ground in Agricultural Economics will be preferred. The project evaluation specialist will also serve as team leader. There will be a Cameroonian Counterpart with extensive knowledge of institutional and international agricultural development.

QUALIFICATION OF THE EXTERNAL TEAM MEMBERS

1. EVALUATION SPECIALIST

Expert with previous experience in project development, evaluation and management, graduate level training in Social Science/Agricultural Economics with considerable field experience in LDC, preferably in Coastal West Africa. Experience in Agricultural Development and knowledge of AID Management at the Mission level is desirable.

2. AGRONOMIST/PLANT BREEDER

Expert in Crop production with special emphasis on Plant Breeding. Graduate level training in Agronomy/Crop Science/Plant and Soil Science. Extensive knowledge in root and tuber crops is desirable. Although field experience is desirable this may be substituted for relevant experience in working with limited resource farmers or small scale agriculture programs in the U.S.

3. INSTITUTIONAL DEVELOPMENT SPECIALIST

Expert in Institutional Development with graduate level training in Social Science/Sociology/Agricultural Extension Education. Extensive knowledge of institutional development, Socio-economic Development, Research and Educational Development

in Cameroon is essential. Some knowledge of farming systems and extension education in Cameroon could be beneficial. Knowledge of research and higher education structure and training needs is desirable.

4. INSTITUTIONAL OBSERVERS

Cooperating institutions are encouraged to send observers who may lend their expertise to the project and the evaluators as well as gain valuable experience in project evaluation and management. Costs for these observers are covered by their institutions (PSG funds or other).

VII REPORTING REQUIREMENTS

The format for the report should be in accordance with section 3.5.7 of AID Evaluation Handbook (April 1987 version) and shall include:.

a. Executive Summary
b. Project Identification Data Sheet.
c. Table of Contents.
d. Body of Report.
e. Appendixes.

The first draft of the report has to be completed by August 14, 1989 and final report submitted to USAID by September 11, 1989. The evaluation team leader is responsible for submitting the final revised evaluation report. He is also responsible for completing the abstract and narrative sections of the AID Evaluation Summary Form.

VIII. **BUDGET**:

The budget for the three person, three week assignment shall be:

Salaries:.....

Perdiem.....

Travel:.....

Misc.....

LIST OF DOCUMENTS TO BE PROVIDED IN USA

1. Project Proposal
2. Annual Plan of Work for years 1,2, and 3
3. Five year Plan of Work
4. Annual Reports for 1987 and 1988
5. Two Financial Audit and Inventory Reports
6. Policies and Procedures Documents
7. Diagnostic survey Report
8. Short term training needs assessment Report
9. All trip Reports.
10. Executive committee minutes.
11. All relevant project Technical Reports and Working Papers will be provided to the team upon arrival in Cameroon.
12. NCRE Evaluation Report.
13. IRA Action Plan.

ROTREP EVALUATION SCHEDULE

Evaluation Team Visit UMES:
26th and 27th of July, 1989

FRIDAY JULY 28 - Team leaves USA.

SATURDAY JULY 29 - Team Arrives Douala and continues to Yaounde.

SUNDAY JULY 30 - Rest.
Review of Project Documents.
Meeting with Project Manager and Chief of Party.

MONDAY JULY 31 - A.M. - Briefing and Orientation - USAID.

P.M - Meeting with GRC/IRA Officials.

TUESDAY AUGUST 1

A.M. - Meeting with GRC/IRA individuals, NCRE and other collaborators.

P.M. - Meeting with USAID Mission Director and staff.

Depart for Ekona.

WEDNESDAY AUGUST 2

A.M. - Courtesy call on Chief of Center, IRA EKONA. Meeting with and Seminar Presentation by Project Scientists.

P.M. - Visit Laboratories, Offices and Store.

THURSDAY AUGUST 3

A.M. - Meeting individually with COP, US Scientists and Counterpart Scientists.

P.M - Visit ROTREP Field Plots.

FRIDAY AUGUST 4

A.M. - Meeting with Administrative Staff, Collaborators and review of project linkages.

- Schedule individual Meetings. Wrap-up session with Ekona Researchers and staff.

SATURDAY AUGUST 5

A.M. - Visit Bonakanda Farming Community.
P.M. - Depart for Douala

SUNDAY AUGUST 6 - Rest in Douala.

MONDAY AUGUST 7

7 A.M. - Visit Njombe Center:- Tour Research Facilities
Meeting with Scientists, and discuss ROTREP related activities.

3 P.M. - Depart for Dschang.

TUESDAY AUGUST 8

A.M. - Visit Dschang University Center and IRA Station.

P.M. - Report writing.

WEDNESDAY AUGUST 9

A.M. - Depart for Yaounde.

P.M. - Report writing.

THURSDAY AUGUST 10

A.M. & P.M. - Report writing.

132

FRIDAY AUGUST 11

A.M. - Report writing.

4 P.M. - Meeting with Mission Director for last minute details.

8 P.M. - Working Dinner with AID Mission Director, Project Manager, Director of IRA and Chief of Party.

SATURDAY AUGUST 12 - **Continue with Report writing**

SUNDAY AUGUST 13 - F R E E

MONDAY AUGUST 14

12 noon - Distribution of 1st Draft of Report

TUESDAY AUGUST 15

9 - 10 A.M. - Oral presentation of 1st Draft of Report.

10 - 11 A.M. - USAID/GRC/Contractor comments on 1st Draft of Report.

11 A.M. - 5 P.M. - Revise Draft as appropriate.

WEDNESDAY AUGUST 16

10 - 11 A.M. - Exit interview with Mission Director.

2 P.M. - Team Departs for USA.