

AGENCY FOR INTERNATIONAL DEVELOPMENT PROJECT PAPER FACESHEET TO BE COMPLETED BY ORIGINATING OFFICE		1. TRANSACTION CODE ("X" appropriate box) <input type="checkbox"/> Original <input type="checkbox"/> Change <input checked="" type="checkbox"/> Add <input type="checkbox"/> Delete	PP <hr/> DOCUMENT CODE 1093
2. COUNTRY/ENTITY <u>1/</u> WARDA		3. DOCUMENT REVISION NUMBER No. 1	
4. PROJECT NUMBER 698-11-190-382	5. BUREAU a. Symbol <u>AFR</u> b. Code	6. ESTIMATED FY OF PROJECT COMPLETION FY <u>8 0 </u>	
7. PROJECT TITLE - SHORT (stay within brackets) <input type="checkbox"/> Rice Research and Production <input type="checkbox"/>		8. ESTIMATED FY OF AUTHORIZATION/OBLIGATION a. INITIAL <u>mo. 2 yr. 75</u> b. FINAL FY <u>8 0 </u>	

9. ESTIMATED TOTAL COST (\$000 or equivalent, \$1 = 5,100)

a. FUNDING SOURCE	FIRST YEAR FY <u>75</u>			ALL YEARS		
	b. FX	c. L/C	d. Total	e. FX	f. L/C	g. Total
AID APPROPRIATED TOTAL	737	-	737	381.6	1320	5,166
(Grant)	(737)	(-)	(737)	(381.6)	(1320)	(5,166)
(Loan)	()	()	()	()	()	()
Other						
U.S.						
HOST GOVERNMENT <u>2/</u>						
OTHER DONOR(S)	-	-	-	139	161	300
TOTALS			737	3985	1181	5,466

10. ESTIMATED COSTS/AID APPROPRIATED FUNDS (\$000)

a. Appropriation (Alpha Code)	b. Primary Purpose Code	c. Primary Tech. Code	FY <u>75</u>		FY <u>76</u>		FY <u>77</u>		ALL YEARS	
			d. Grant	e. Loan	f. Grant	g. Loan	h. Grant	i. Loan	j. Grant	k. Loan
FN			737		1,030		992		5,100	
TOTALS			737		1,030		992		5,166	

11. ESTIMATED EXPENDITURES

12. PROJECT PURPOSE(S) (stay within brackets) Check if different from PID/PRP

To develop and disseminate new high yielding rice varieties and cultural practices for specified rice types of regional priority in West Africa.

13. WERE CHANGES MADE IN BLOCKS 12, 13, 14, or 15 OF THE PID FACESHEET? IF YES, ATTACH CHANGED PID FACESHEET.

Yes No N.A.

14. ORIGINATING OFFICE CLEARANCE		15. Date Received in AID/W, or For AID/W Documents, Date of Distribution
Signature E. Dennis Conroy	Date Signed mo. day yr. 0 3 9 7 6	
Title Director, AFR/RA	mo. day yr. 	

AID 1330-4 (7-75)

1/ West Africa Rice Development Association (WARDA).
2/ WARDA and Government of Mali contributions in kind (Refer to pg. 42, Financial Analysis).

This Project Paper is revised for the following reasons:

a. To include additional financing beginning in FY 76 for expanding rice research facilities at Mopti, Mali. (PP Amendment for Mopti Activity attached).

b. To extend the timeframe to FY 80 in order to provide a five-year scope for the Mopti sub-activity which is necessary for the achievement of the project purpose.

c. To modify project inputs and certain cost estimates on the basis of experience gained during the first year of project implementation. Specifically, the original PP is modified to add a direct hire Extension Training Advisor for a three-year period beginning in December, 1975; an increase in costs of construction of the Training Center at Johnsonville due to architectural modifications for a new total cost of \$305,000 in FY 75 and \$30,000 in FY 76; an increase in our extension of the funding of operating costs for Rokupx and the Training Center in the amount of \$186,000 in FY 78 and \$201,000 for FY 79.

It is recommended therefore that A.I.D. fund a specific, clearly identifiable portion of WARDA's program of rice research and development at a level of \$737,000 for FY 75, \$1,030,000 for FY 76, \$125,000 for the Interim Quarter, \$992,000 for FY 77, \$863,000 for FY 78, \$930,000 for FY 79 and \$489,000 for FY 80 for a total of \$5,166,000.

This facesheet presents totals for only the WARDA-Mopti Activity within the Rice Research and Production project.

AGENCY FOR INTERNATIONAL DEVELOPMENT PROJECT PAPER FACESHEET TO BE COMPLETED BY ORIGINATING OFFICE		1. TRANSACTION CODE ("X" appropriate box) <input type="checkbox"/> Original <input type="checkbox"/> Change <input checked="" type="checkbox"/> Add <input type="checkbox"/> Delete	PP DOCUMENT CODE 3
2. COUNTRY/ENTITY WARDA 1/		3. DOCUMENT REVISION NUMBER No. 1 (WARDA-Mopti Activity)	
4. PROJECT NUMBER 698-11-190-382	5. BUREAU a. Symbol b. Code AFR		6. ESTIMATED FY OF PROJECT COMPLETION FY 810
7. PROJECT TITLE - SHORT (stay within brackets) <input type="checkbox"/> Rice Research and Production (PP Amendment for WARDA-Mopti Activity)		8. ESTIMATED FY OF AUTHORIZATION/OBLIGATION a. INITIAL ^{mo. yr.} 5 76 b. FINAL FY 810	

9. ESTIMATED TOTAL COST (\$000 or equivalent, \$1 = 2,761)

a. FUNDING SOURCE	FIRST YEAR FY 76			ALL YEARS		
	b. FX	c. L/C	d. Total	e. FX	f. L/C	g. Total
AID APPROPRIATED TOTAL 3/	244	311	555	1,141	1,320	2,461
(Grant)	(244)	(311)	(555)	(1,141)	(1,320)	(2,461)
(Loan)	()	()	()	()	()	()
Other 1.						
U.S. 2.						
HOST GOVERNMENT 2/						
OTHER DONOR(S)				139	161	300
TOTALS	244	311	555	1,281	1,480	2,761

10. ESTIMATED COSTS/AID APPROPRIATED FUNDS (\$000)

a. Approp-riation (Alpha Code)	b. Primary Purpose Code	c. Primary Tech. Code	FY 76		FY 77		FY 78		ALL YEARS	
			d. Grant	e. Loan	f. Grant	g. Loan	h. Grant	i. Loan	j. Grant	k. Loan
			555		549		414			2,461
TOTALS			555		549		414			2,461

11. ESTIMATED EXPENDITURES

12. PROJECT PURPOSE(S) (stay within brackets) Yes No Check if different from PID/PRP

To develop and disseminate new high yielding rice varieties and cultural practices for specified rice types of regional priority in West Africa.

13. WERE CHANGES MADE IN BLOCKS 12, 13, 14, or 15 OF THE PID FACESHEET? IF YES, ATTACH CHANGED PID FACESHEET.

Yes No

14. ORIGINATING OFFICE CLEARANCE		15. Date Received in AID/W, or For AID/W Documents, Date of Distribution mo. day yr.
Signature: E. Dennis Conroy		
Title: Director, AFR/RA	Date Signed: mo. day yr. 0 3 0 9 7 6	

AID 1330-4 (7-75) 1/ West Africa Rice Development Association (WARDA).
 2/ WARDA and Government of Mali contributions in kind. (Refer to Pg. 42, Financial Analysis)
 3/ New appropriation for WARDA-Mopti activity in addition to funds already appropriated for the Rice Research and Development project.

OUTLINE

RICE RESEARCH AND PRODUCTION AMENDMENT NO. 1

(WARDA-MOPTI ACTIVITY)

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I. Summary and Recommendations

A. FACESHEET - See Facesheet

B. RECOMMENDATIONS

1. It is recommended that the Rice Research and Production Project be amended to increase total funding by the additional amount needed to fund the WARDA-Mopti activity as follows:

a. Total additional grant requested -- \$2,461,000 (for five years commencing FY 1976);

b. Additional grant requested in FY 1976 -- \$530,000¹/₁

2. Waiver of certain AID source and origin procurement requirements and certain other regulations are included in this Project Authorization. A summary of the waivers follows:

a. A procurement source waiver under M.O. 1412.1 to permit the selection of a local or geographic code 941 (Selected Free World) firm(s) to perform the construction services required for the construction and improvement of the Mopti-North Rice Research Station.

b. A waiver of AID Regulation 7 restrictions on financing the costs of construction work performed by third country nationals.

c. A waiver of Section 636(i) of the FAA, as amended, which requires that AID financing be restricted to motor vehicles manufactured in the United States. Cost of the vehicles to be purchased is estimated at \$31 thousand, probably from code 935 sources (Special Free World).

d. A waiver of procurement source and origin requirements for grant funded commodities from Code 000 (U.S.) to, in part, Code 935 (Special Free World) and, in part, Code 941 (Selected Free World) for building products and materials valued at an estimated \$240 thousand; and to Code 935 for scientific instruments and laboratory equipment valued at an estimated \$35 thousand.

3. The Administrator is also requested to approve the financing of local cost expenditure, estimated at \$1,480.4 thousand, related to the construction and operation of the Mopti-North Research Station over the five year development period. Projected local cost expenditures are detailed in Annex B, Table 2.

4. Further explanation and justification of waivers and local costs are presented in Annex E, "Waivers and Local Costs".

¹/ Twenty-five thousand dollars from AID grant funds already allotted for FY 1976.

5. By his signature on this Project Authorization, the Administrator or Deputy Administrator:

-- approves a source waiver under M.O. 1412.1 to permit AID-financed procurement from local and/or Code 941 firm(s) in equal preference with U.S. firms, U.S.-controlled local firms, and joint ventures thereof, of construction services required for the construction and improvement of the Mopti-North Rice Research Station, and, in support of said waiver, determines that such procurement will best serve the interests of the U.S.

-- waives the applicability to this project of AID Regulation 7 (Limitation on the Employment of Third Country Nationals for Construction Work from U.S. Foreign Assistance Funds) for the limited purpose of permitting the employment of third country nationals in technical positions by any local and/or Code 941 firm(s) which may be selected to perform construction services required for the construction and improvement of the Mopti-North Rice Research Station, and, in support of said waiver, determines that it is important to the national interest of the U.S. that the direct costs of any such construction work as may be performed by third country nationals be financed out of funds made available by the applicable Foreign Aid and Related Agencies Appropriation Act(s).

-- waives, for purposes of this project, the provisions of section 636(i) of the Foreign Assistance Act of 1961, as amended, based upon the special circumstances described in Annex E.

-- approves a procurement source waiver from Geographic Code 000 (U.S. only) to Geographic Code 935 (Selected Free World) for building products and materials and scientific instruments and laboratory equipment required for the construction and equipping of the Mopti-North Research Station facilities, provided, however, to the extent that any or all such commodities can be procured from the U.S. or, as a second preference, from other Geographic Code 941 countries without seriously impeding or otherwise substantially affecting adversely achievement of project purposes, such commodities shall be procured from such U.S. or Code 941 source countries; and hereby certifies (a) that exclusion of procurement from the sources described in Annex E in support of the requested Code 935 waiver would seriously impede attainment of U.S. foreign policy objectives and the objectives of the Foreign Assistance program, and (b) that procurement from the Code 941 sources requested in Annex E is necessary to the attainment of U.S. foreign policy objectives or objectives of the Foreign Assistance program.

C. SUMMARY PROJECT DESCRIPTION.

This amendment to the Rice Research and Production^{1/} project number 698-11-190-382 will expand AID support to the West Africa Rice Development Association (WARDA) to include the improvement and acceleration of a deep water/floating rice research program at Mopti, Mali (henceforth referred to as the "WARDA-Mopti Activity"). Support to deep water/floating rice research constitutes a major element of WARDA's strategy to support adaptive research at regional centers of excellence in West Africa on rice types of regional priority. In addition to the Mopti activity, the WARDA strategy includes support to upland rice research at Buoake, Ivory Coast; mangrove swamp rice at Rokupr, Sierra Leone (AID funded); and Sahel zone irrigated rice at Richard Toll /Fanaye, Senegal.

To support the Mopti activity, AID would provide an additional grant over five years to finance the salaries and support for rice scientists, the construction and equipping of facilities at the Mopti-North Research Station, initial research station operating costs, and participant training. Costs for continued operating support in the fourth and fifth year of the activity would be approximately \$450,000 annually. Much of the Mopti-North research station infrastructure including the principal dikes, canals, experimental polders and station buildings' site was constructed in 1971-74 under the "Operation Riz Mopti" rice development project. Existing infrastructure is valued at about \$342,000. AID is currently providing \$56,000 under the existing grant to finance one year of postgraduate training for each of four Malian assistant scientists scheduled for assignment to the Mopti North station. In 1976, Saudi Arabia committed \$300,000 over three years to the establishment of the Mopti-North Research Station.

The overall objective of the WARDA-Mopti Activity is to develop improved deep water/floating rice varieties and cultural practices to overcome production constraints of small farmers in the WARDA region. Project scientists are to perform as an integrated team concentrating complementary scientific guidance resources (critical mass) on the resolution of mutual objectives. Scientific guidance will be provided by WARDA, through its Scientific and Technical Committee, in coordination with international crop research institutions and the Government of Mali (GOM) Institut d' Economie Rural (IER), responsible for crop research in Mali. Scientist consultants will be ~~hired~~ to provide specialized short term research assistance as required.

Two expatriate senior scientists and an agriculture research/extension liaison specialist will be provided. The two expatriate senior scientists will serve as the station director and deputy for the entire period of the project. The station director will be the key figure in

^{1/} Project name changed in FY 1976 ABS from West Africa Rice Development Association (WARDA) to Rice Research and Production.

administering the research station and directing the daily scientific work of the African assistant scientists. The deputy will greatly augment the amount of effective direction available at the station thereby allowing sufficient senior scientist direction of the vital research, outreach and training elements of the Mopti activity. The research/extension specialist will visit extension services of member countries to provide information on Mopti trials and ascertain status of the extension of research packages developed. The four Malian assistant scientists, who will be completing training in June, 1976, will perform research in breeding, agronomy, weed control and entomology under the direction of the senior scientists. Two to four additional African scientists will receive a total of four years of similar postgraduate training in the second year of the Mopti activity. In the fourth and fifth years of the activity, at least one Malian scientist, who has demonstrated capability and motivation, will be sent for advanced academic training.

Training and personnel will be provided to conduct innovative farmer field trials and other activities to direct Mopti research to actual farmer production constraints and to induce the dissemination of appropriate research results. One African specialist will be trained and assigned full-time to these "outreach" duties at the Mopti station which are to be fully integrated into the station's research program. Training is also for additional specialists for other countries, i.e., Niger and Guinea-Bissau.

Mopti-North is a new research station and a substantial amount of additional infrastructure development is required. Six houses will be built, one for each assistant scientist, one for the deputy station director and one guest house for visiting scientists and consultants. One house has already been constructed for the station director. Several station buildings will be constructed including an administrative building, three laboratory offices, a green house, a screen house and a threshing floor. Certain sheds and storage areas already exist. While the basic experimental farm infrastructure exists, certain additional interior plot development and hydraulic infrastructure improvement is needed. Electrical, potable water and sewage systems, guard houses and fencing must be installed to service all of the above.

Station operating costs will be financed beginning in year two of the project including staff salaries; office, lab, transportation and farm equipment and supplies.

Outputs are 1) an on-going experimental program, 2) a field-trials/outreach system, 3) trained scientists, and 4) a completed station infrastructure including the station administrative systems. The attainment of these outputs should lead to the achievement of project purpose, i.e., to develop and disseminate improved rice varieties and practices. Research results are not very predictable but reasonable indicators of purpose level achievement are summarized as EOPS conditions.

D. SUMMARY FINDINGS.

WARDA's mandate to coordinate and support regional rice development efforts in order to attain regional self-sufficiency remains imperative. Rice continues to increase in importance as a food in West Africa, and regional imports remain high (\$235 million in 1974). Regional cooperation is critical for rice research because "no single country can make the investment that cereal crop research requires".^{2/}

Deep water/floating rice research at Mopti has good potential for technological advance and economic benefit, if directed with sufficient resources toward farmer production constraints. Over 340,000 ha. of deep water/floating rice are cultivated in the WARDA region, representing about 23% of the total area in rice. The potential for expanding the area and production of this rice type appears large. Deep water/floating rice may become relatively more important in meeting regional rice consumption needs because of relatively high yields, low development costs and lack of alternative uses for the flood land and water.

The waters of the Niger River represent the most important development resource in the central Sahelian-Sudanian zone of West Africa. Research at Mopti is not only ideally located from a technical standpoint, but it could contribute importantly to the development of rice in the zone. The existence of the huge "Operation Riz Mopti (ORM)" rice development project offers immediate opportunity to test and apply research results generated at Mopti.

By directing adaptive research toward farmer production constraints and inducing the dissemination of research results to farmers, the Mopti activity addresses two of the most serious constraints to successful grain research in Africa-- the inapplicability and the non-application of research results to farmers fields.^{2/}

^{2/} p. 122 Development Assistance Program, CMA, FY 1975, AID draft report Feb. 1975.

^{3/} Ibid Reference pages 114-126.

The Mopti activity will contribute importantly to developing African research scientists and infrastructure which are in short supply and are critical to long term food self-sufficiency in West Africa.

E. PROJECT ISSUES.

In designing this activity, special consideration was given to the following aspects:

1. Scientific leadership and staffing at the Mopti North Station

The geographic isolation and general lack of amenities at Mopti are expected to make it difficult to recruit senior scientific personnel to serve there. This activity calls for a viable minimum of two senior staff, one a very experienced senior scientist as station director and one less experienced but highly trained scientist in a complementary discipline. The remaining research positions will be filled by five assistant African scientists with practical postgraduate training. The reliance on African scientists minimizes the need for expatriates, greatly reduces costs and facilitates African scientific skills. It may be necessary to rely on third-country nationals, probably from Bangladesh, India, Ceylon or Pakistan to fill one or more of these two senior positions in the event that no U.S. scientists are available.

2. Means for translating research into production benefits.

Experience with crop research in LDCs has demonstrated the frequent inapplicability or non-application of research results to farmers fields -- two separate but related problems.

The Mopti activity incorporates elements to address these problems:

a. Crop research will be directed to actual farmer production constraints (technical, economic and social) identified through farmer field tests and social-economic farm research.

b. The translation of research results into production benefits depends on a range of economic, social, political and administrative factors. Nevertheless, the design emphasizes incorporation of actions and liaison activities at the Mopti North and WARDA levels to facilitate the "outreach" of research results. The mechanisms for outreach also include farmer field trials (demonstrations), direct Mopti-North liaison with Malian extension personnel and increased WARDA emphasis on guiding national extension agencies.

3. Project Management by WARDA and the Government of Mali (GOM).

While support to Mopti research is similar to current AID-WARDA support to Rokupr research, the inputs and practical problems at Mopti-North are much greater. The Mopti-North station and research programs are comparatively much less developed. The station is more geographically isolated from both WARDA and national government management. Considerable WARDA-GOM collaboration is required at all phases of implementation, i.e. construction, administration and research. Thus, the activity design specifies the appointment of a senior WARDA project manager who can devote sufficient time to the Mopti activity, a GOM counterpart, and a WARDA-GOM Letter of Understanding spelling out mutual implementation responsibilities, procedures and schedules.

F. Project Design Team

Gary D. Adams	_____	Project Design Officer, AFR/DR
Rufus K. Walker	_____	Rice Research Consultant, retired, Ford Foundation
Thomas E. Daves	_____	Agricultural Economist, South Dakota State University
Moses J. Morgan	_____	Agricultural Engineer, REDSO/WA
Francois Faye	_____	Field Trials Coordinator, WARDA
Peter K. Daniells	_____	WARDA Project Manager, USAID/Liberia

G. Additional AID/W Project Committee Staff

Charles Sanders	_____	Agriculture Officer, AFR/RA
J. E. Hill	_____	Project Officer, AFR/RA
Wendell Anderson	_____	Engineer, SER/ENGR
Thomas A. Muntsinger	_____	General Counsel

PART II. BACKGROUND AND DETAILED DESCRIPTION

A. BACKGROUND

1. WARDA Programs.

Established in July 1971, WARDA is now in its fifth year. The institutional machinery of WARDA has been streamlined to improve efficiency and steps taken to provide for more rapid Africanization of all staff positions in the Secretariat. The several committees established to oversee and advise on WARDA programs are being reduced to two, the Governing

Council, comprised of member nation representatives, and the Scientific and Technical Committee. Also, a special fund financed largely by member contributions is proposed to finance special projects for which external financing is not available; to finance parts of projects which cannot be financed by the donors and to bridge gaps between the time a project is approved and funds actually become available.

WARDA continues to attract intensive regional and international interest and a large volume of financial support. The operating budget for CY 1976 is expected to exceed \$4.5 million, with \$577,300 coming from member nation contributions.

The important role of AID support to WARDA has been discussed in the original PP, p. 14. In 1971, AID's initial \$625,000 grant helped finance WARDA's start-up and the W-1 varietal trials program. In 1975 AID decided to support WARDA's regional research and extension training programs. In FY 1975, a \$737,000 grant was authorized to finance scientist training, technical assistance and facilities for mangrove rice research at Rokupr, Sierra Leone, and the construction and operation of a regional rice production training center at Johnsonville, Liberia. An AID evaluation of this project in November 1975 showed progress to be satisfactory although original implementation schedules were overly optimistic.

WARDA programs were described in some detail in the original 1975 PRP. An updated summary of WARDA's current programs is attached as Annex C to this PP amendment.

2. Mopti Activity.

WARDA requested AID support to regional research at Mopti, Mali (deep water/floating rice) and Richard Toll, Senegal (irrigated rice) as part of its proposal to AID in 1974. The design team, which developed the PP for support to Rokupr and the training center in Liberia, also visited Mopti and Richard Toll in September 1974. The team noted that both research activities appeared to represent important regional initiatives, but that more study was needed regarding project design and economic and technical feasibility. The FY 75 grant agreement with WARDA included \$105,000 for postgraduate training for eight African research assistants. These scientists were to be available to staff the Richard Toll and Mopti stations later should those activities be developed.

The PP stated the intention to provide additional funding to these research activities under the WARDA project, pending the results of further analysis. Cost estimates were too vague to allow authorization of funds for Mopti or Richard Toll in the PP.

In 1975, WARDA proceeded with additional planning and analysis of the two activities. A study was prepared on the rice economy and research potential in the Sahel, "Development of Rice Cultivation in the Sahel countries", June 1975. WARDA conducted a series of consultations with the Government of Mali resulting in a detailed Mopti activity proposal, "WARDA's Integrated Rice Programs -- Assistance to the Specialized Research Program on Deep Water and Floating Rice at Mopti North Experimental Station, Mopti, Mali," 1975.

Also, Dr. Chandler, the renowned former director of IRRI, visited Mopti under Consultative Group auspices and expressed a favorable opinion of the WARDA plans.

AFR/RA subsequently expressed preference for the Mopti activity because of the large numbers of small farmers engaged in the cultivation of deep water/floating rice and the more immediate economic potential represented. WARDA later entered into discussions with CIDA (Canada) for support to Richard Toll.

This PP amendment has been drafted as a result of a design team mission to Liberia and Mali in October 1975 to appraise the revised WARDA proposal for support to the Mopti activity.

3. DETAILED DESCRIPTION.

The Mopti activity represents an expanded but integral part of AID assistance to WARDA under the on-going project. The rationale for support to research on deep water/floating rice at Mopti, Mali is very similar to the rationale for current AID support to mangrove rice research at Rokupr, Sierra Leone. In each case, research support is being concentrated on a rice type of regional priority which has previously received only diffused and sporadic research attention.

The scope and cost of AID's contribution to the Mopti activity is much greater than to the Rokupr activity, however. Whereas rice research at Rokupr was an on-going and expanding activity heavily supported by the United Kingdom and the UNDP, rice research at Mopti has been largely discontinued because of the phased withdrawal of French (IRAT) support to crop research as a result of the planned WARDA project. Hence the design of the Mopti activity is considerably more detailed than was the Rokupr activity design in the original PP, reflecting the greater cost, complexity and AID role in the Mopti activity as well as recent experience in implementing the Rokupr activity.

While the goal, purpose and principle outputs remain largely unchanged, the logical framework has been revised to reflect certain unique

aspects of the Mopti activity as well as other refinements. The Mopti activity is described below in terms of the revised logical framework.

B.1. Logical Framework

1. Goal.

The project goal is unchanged: "To increase the quantity and quality of rice production in West Africa in order to approach regional self-sufficiency."

2. Purpose.

a. Narrative Summary -- The twofold project purpose remains unchanged:

To develop new high yielding rice varieties and improved cultural practices for specified rice types of regional priority.

To disseminate high yielding varieties and improved cultural practices to West African farmers.

The Mopti research activity contributes principally to the first project purpose. Features have also been designed into the Mopti activity to contribute to the achievement of the second project purpose by strengthening the linkages at Mopti between research and dissemination.

b. Objectively Verifiable Indicators and Means of Verification.

1) Research - The original PP noted the unpredictability of research results and the consequent difficulties in specifying and scheduling "End of Project Status (EOPS)" conditions indicating purpose level achievement. Nevertheless, the original PP design specified EOPS conditions according to reasonable expectations of research and training results. Research EOPS have been revised slightly. Reference Table 1.

The 1979 EOPS condition for the Rokupr activity specifies the development of rice lines displaying improved characters. Similar research results cannot be expected at Mopti until at least 1980 because of the later start of project activities at Mopti. The revised EOPS reflects this change in timing.

Research station reports and records on field trials and experimental trials will be the primary means of verifying achievement of EOPS conditions.

2) Dissemination - To indicate the impact of the Mopti activity in "disseminating rice research results to farmers" (The second project purpose), a new EOPS has been added to the logical framework as follows:

FY 1979 -- 2.a. Varieties and practices developed at Mopti and Rokupr are being field tested and demonstrated by cooperating national agencies.

Evidence that Mopti "production packages" are being widely tested or demonstrated by national research or extension agencies is not proof that the vital research outreach link has been fully achieved, but is a valid indicator that the Mopti research station and WARDA are effectively establishing the essential organizational links to move research results out of the laboratory. Verification that Mopti recommended packages are being field tested and extended will be provided by Mopti station records regarding its field trials programs.

c. Assumptions

"Outreach" activities undertaken at Mopti represent only the initial steps required to disseminate improved rice varieties and practices to farmers. Thus, the assumptions in the original FP remain essential, that is: national research and extension agencies provide the support and resources necessary to meaningfully test or use new varieties or practices in response to WARDA guidance and encouragement. In a broad sense this assumption relates fundamentally to WARDA's overall role in West Africa to effectively coordinate and guide the application of regional research and extension to rice production.

3. Outputs

A new output has been added to the logical framework to reflect the "outreach" element of the Mopti research station activity.

Output no. six -- A Mopti station program/procedure capable of providing answers to national governments and farmer group problems in order to increase farm production. This will necessitate field testing by both WARDA and other agencies as well as extension by other agencies of the research being developed or tested at Mopti.

This output relates to the emphasis throughout this activity design to 1) relate and test research results under farm conditions; 2) direct the application of select research results to ascertain production benefits in farmers fields; and 3) identify constraints at the farmer production level for referral to researchers for further research so as to assure maximum two way flow of information between researchers/production specialists/farmers.

Table 1. Research Purpose Level "End of Project Status" Conditions.

<u>Purpose Level Objectively Verifiable Indicators</u>		<u>Means of Verification</u>
(End of Project Status (EOPS Conditions))		
FY 1981 (Rokupr) FY 1982 (Mopti)	Improved rice lines and related cultural methods developed which produce higher yields than currently recommended varieties and methods under farm conditions.	Field trial records -- Comparison of yields based on field trials conducted by the WARDA regional research stations and by other participating research stations and national development or extension agencies.
FY 1979 (Rokupr) FY 1980 (Mopti)	Rice lines and methods developed which display targeted characters related to higher yield or better disease, pest or weed resistance, or growth duration, dormancy, stem elongation, etc.	Records of experimental results -- Targeted characters have been demonstrated under experimental conditions at the WARDA regional research stations.
FY 1978 (Rokupr) FY 1979 (Mopti)	Screening has resulted in the identification of materials with promise for achieving research targets.	Records of experimental results -- Experiments have indicated breeding materials and methods with apparent potential and these have been selected for further work.
FY 1977 (Rokupr) FY 1978 (Mopti)	Rokupr and Mopti research adheres to regional priorities.	Research workplan -- Existence and use of station workplans approved by WARDA.

WARDA supported regional research stresses applied research with prospects for early pay back. Considerable useful information developed at the IRAT station is already known or could be derived through increased emphasis of relatively simple field testing in the case of known rice production technology. Adaptive research must be coordinated with field trials and extension and training programs for early pay offs on relatively elementary cultural practices. (Reference "Economic Analysis" C.7., for further rationale and description of the innovative field testing and outreach aspects of the Mopti Activity).

To achieve this output, an expatriate officer or an additional African assistant scientist will be recruited and sent to one year of specialized postgraduate training in rice research/extension production techniques. This Agricultural Extension/Research Liaison Specialist would be the key link between regional researchers and national agricultural agencies and producers, including farmers field trials and outreach. He will be responsible, under the direction of one of the two senior scientists to 1) prepare "simple production packages" of recommended practices in useable form for testing or outreach, 2) develop technical instructions related to the packages, 3) help plan and organize farmer field trials in conjunction with WARDA and other cooperating agencies, 4) develop training materials and perhaps, even to assist in planning, organizing and conducting training courses for CRM and other cooperating agency field trials or extension personnel, and 5) routinely coordinate with WARDA regarding the introduction of new materials into the WARDA "Preliminary variety trials (PVT)", Initial Evaluation Tests (IETs) or Coordinated trials (W-1), 6) Appraise farmer field trial results and provide appropriate feedback to redirect the Mopti research program, 7) Coordinate with the economic/social field research being conducted by CRM and provide appropriate feedback to redirect the Mopti research program. In sum, he will be primarily responsible to relate the experimental work to farmer conditions and to organize the dissemination and testing of Mopti research results.

Objectively Verifiable Indicators - (Magnitude of Outputs).

a. OVIs for this new output are:

- 1) Plans and methodologies developed to field test or demonstrate in farmers fields new varieties or practices developed or being developed at Mopti.
- 2) Technical instructions developed on recommended varieties and practices.

3) Training materials developed and courses organized to train research field trials workers and/or extension officers of cooperating agencies in the methodologies and technologies for conducting field trials/ or demonstrations.

4) Routine distribution of the above materials to WARDA for use in WARDA's regionwide trials and extension programs.

Verification of the output OVI's can be provided by 1) reference to the Mopti station plans, instructions and reports specified above and 2) observation of WARDA's regional trials programs to determine if Mopti materials have been introduced.

b. Other Outputs

Other important outputs on the original log frame which have been modified slightly to reflect the Mopti activity and to otherwise strengthen the outputs include:

1) Integrated rice research experiments in breeding, weed control, entomology, agronomic practices and pathology to address the major constraints to increasing yields of rice types of regional priority, including mangrove swamp rice at Rokupr and deep water/floating rice at Mopti. The experimental program at Mopti will be conducted by the four assistant scientists under direction of the senior scientist station director and his deputy. The experiments program will further evaluate deep water/floating rice production constraints and address those constraints through the identification and development of varieties, lines and cultural practices that display the high yield and targeted pest and disease resistant characteristics. The experimental program will be coordinated with the field trials program to lead to the development of improved "recommended production packages". WARDA has already made tentative arrangements for a team of experts from IITA, IRAT and IRRI to assist in planning the research program.

Research experiments at Mopti will emphasize varietal improvement; weed control, particularly of wild rices; agronomic practices; and insect control, particularly against stem-borers. Research objectives and approaches are discussed in more detail under "Technical Analysis", A.1.4.

The objectively verifiable indicator related to this output remains unchanged: Comparison of each individual scientist's actual experimental program against the individual programs outlined in the research station workplan.

2) Trained African Scientists.

African scientists are to be trained in various scientific disciplines in order to conduct the experimental program and to take over station management at the end of the project development period. Four Malian scientists are currently receiving one year of specialized post graduate training, under the WARDA project, in rice production and in their individual scientific disciplines at IRRI* and BRRI** in rice agronomy, breeding, weed control and entomology. They will complete their training in June 1976 and be assigned to the Mopti North station. (See inputs - Participant training).

The four assistant scientists are to receive close on-the-job training from the station director and deputy. In the initial three year Mopti funding period, research will be on-going for only one to one and a half years but field trials with existing information will be initiated during the first 2 years. Additional AID funding would be required in years four and five of the Mopti activity to fund the senior scientists and to permit a meaningful period of research and on-the-job training.

Two to four additional assistant scientists will be assigned to Mopti following postgraduate training to add depth and reduce risk. One of these would be the agriculture research/extension liaison specialist discussed above. One or two of the assistant scientists who have demonstrated their aptitude, competence and general suitability for advanced scientific research and leadership should be groomed through additional training for the station director's job at the earliest possible date.

Objectively Verifiable Indicators (for Mopti activity)

2.a. June 1976 -- Four Malian assistant scientists complete one year postgraduate training.

2.b. December 1977 -- Newly recruited assistant scientists complete four man-years of postgraduate training.

2.c. December 1978 -- Each of the four original assistant scientists have received 18 months OJT as members of an integrated rice research team. One or two assistant scientists be selected for one to two years each of academic postgraduate training to the M.S. or Ph.D. level.

* International Rice Research Institute, Philippines
 ** Bangladesh Rice Research Institute, Bangladesh

3) Establishment of Research Facilities. (Output no. 5 on Log Frame)

This output refers to the development of the research station infrastructure including: a) the physical construction and equipping of the station and the housing area and b) the establishment of the administrative systems (financial/accounting/personnel/maintenance, etc.) required for station operation.

The research station and adjacent housing area is to be complete and prepared for full research operations within 21 months by (November 1977). The infrastructure development program will complete the development of the station which was partially constructed in 1971-74 under the Operation Rice Mopti (ORM)" project. (Reference "Technical Analysis" A.2., for more discussion of the existing Mopti North infrastructure).

a) Six scientists' houses - A house for the station director has already been constructed at the Mopti North site. Six more houses will be provided -- five for the four assistant scientists and the station deputy and one guest house to accommodate visiting consultant scientists and other visitors who are essential to the success of this activity. The housing area is located about 800 meters from the Mopti North station proper at a site provided by the GCM. Construction will be conducted to standard GCM specifications for government facilities. Land excavation and foundation/embankment preparation will be needed because of the low topography of the area.

b) Experiment Station Buildings

Administrative office -- This building will serve as the office for the station director and deputy and certain administrative/clerical staff. Office space for the assistant scientists is provided in the three laboratories described below. Offices will be furnished with normal office furnishings, equipment and supplies. Office space is at a minimum at the station, and some additional space may be available in the nearby IRAT building should the need arise.

Laboratories/offices (3) -- three laboratories each with two offices will be constructed to serve as the principle work areas for the scientists. One laboratory/office already exists at the station. Laboratories will also be equipped and supplied under the project and otherwise fully funded for operations as will be the other physical facilities.

Threshing floor -- Will be constructed to permit the mechanical operations related to rice harvesting and processing -- drying, threshing, etc.

Green house -- This building will be attached to one of the laboratories and used principally for the rice breeders work.

Screen house -- This house will be used principally for the entomologists work.

c) Electrical power distribution system; water and sewage.

For electrical power when Mopti city power is not provided, the station and housing areas will be provided with a self-contained back-up electrical generating system. Steady power supply is needed to permit the temperature and humidity control and instrument performance needed for certain scientific work, as well as to allow the scientists' physical comfort and inducement to work in Mopti. Two electrical generators will be installed to service the experiment station (30 kw) and the housing area (60 kw). Air conditioning will be installed in certain offices, laboratories and sleeping areas according to standard GCM regulations regarding the need and eligibility for air conditioning at government research stations. Electrical, water and sewage distribution systems will also be installed as part of the station infrastructure.

Potable water will be acquired from Mopti City where the European Development Fund is financing the installation of a municipal potable water system to be completed in CY 1976.

d) Hydraulic infrastructure improvement

The experimental farm irrigation system at the Mopti-North Station was largely completed during the CRM construction phase. Some improvement is needed, however, in experimental plot conditions and water control within the principle polders. Some plot leveling, diking, construction of interior irrigation and drainage ditches and installation of water gates and mobile pumping stations will be carried out. Prior to the experimental plot improvement, a topographical survey of the station and the adjacent experimental farm will be conducted by the GCM Rural Engineering Division. The Rural Engineering Division will also do the detailed hydraulic infrastructure plan based on the topographic survey and the detailed research workplan.

e) Station Administrative Systems

The non-scientific staff at the Mopti North station will be comprised largely of experienced administrative personnel and farm workers transferred from the Ibetemi station when Mopti North commences operations in mid-1977.

The financial, supply, payroll, personnel and maintenance systems to be applied at Mopti North will be mutually determined through WARDA-GOM negotiations. An administrative officer at the Mopti station will have principle responsibility for maintaining station financial accounts and ensuring that administrative procedures acceptable to WARDA and the GOM are applied. WARDA and the GOM will provide technical assistance to the administrative systems and procedures employed at Mopti North will be those normally used by the GOM at all its research facilities. Some additional accounting and reporting requirements will be applied to fulfill WARDA information needs.

Objectively Verifiable Indicators.

5.a. Achievement of the physical infrastructure outputs will be indicated by comparing the completion and suitability of the structures to the construction/equipping schedule and specifications. The construction schedule and responsibilities have been broken out in table 13, as a subnetwork to the PPT.

5.b. Indicators that the essential administrative systems have been properly established on schedule are:

- 1) Staff salaries are paid promptly and correctly.
- 2) Buildings, equipment and vehicles are maintained with only reasonable "down time".
- 3) Funds for station development and operation are routinely expended and accounted for by station management and promptly reimbursed by WARDA according to established procedures. Station operations are not delayed for financial/accounting/maintenance/supply reasons.

C. Assumptions

Output level assumptions remain the same: 1. All scientific disciplines will be integrated at Mopti into a research team approach.

2. WARDA and GOM research activities will be coordinated and integrated.
3. Assistant scientists will serve in their assigned position after training.
4. The national government will provide personnel and technical inputs as agreed and on schedule.

4. Inputs.

Total Mopti activity costs over the five year period will be \$2,760.9 thousand primarily to finance the salaries and support for rice scientists, the construction and equipping of facilities at the research station, and research station operating costs. Principle expenditure (input) categories are summarized in Annex 3.

B.2. Technical Assistance.

1. Station Director

The senior scientists station director is the key figure in the establishment of the rice research program at Mopti. He will be responsible for overall station management, the scientific direction of the research and OJT training of the assistant scientists. If he can be appointed by early 1977, he can assist in administering WARDA's input into the final stages of the physical and organizational establishment of the station, and prepare for the 1977-78 crop year research program.

The knowledge, experience, leadership and motivation of the station director will be crucial to the success of the Mopti activity. He must be broad-gaged enough, with the help of the station deputy and visiting consultants, to direct the research activities of the inexperienced assistant scientists to a high degree of technical expertise in the fields of entomology, weed control, breeding, agronomic research and related disciplines, and to coordinate their individual research activities into an integrated research effort directed at the priority research targets. He must have considerable experience in directing crop research. Several years experience as the head of a division in a research station would be a minimum requirement. Because of the extremely isolated conditions and lack of amenities in Mopti, the director must be a person who can perform well under difficult circumstances.

Normally, a senior scientist with the qualifications to fill this position would be an agronomist or a breeder, but the disciplinary requirements should be flexible since the characteristics and leadership required for this position are rare and more a function of the individual than of a particular scientific discipline.

Since the research effort has a regional focus, the station director must become knowledgeable of rice conditions, cultural practices and cultivation constraints in important deep water floating rice areas throughout the WARDA region. To effectively direct research and avoid costly duplication of effort, the director will be responsible to coordinate the Mopti research programs with other closely related rice research programs, particularly at Birnin Kebbi and Bedeggi in Nigeria and with rice research stations in the Sudanian-Sahelian zone, including Richard Toll, Senegal, and Kaedi, Mauritania.

2. Deputy Station Director.

Analysis of the Mopti station scientist staffing needs has lead to the conclusion that the provision of a second expatriate scientist would be highly beneficial and greatly reduce the heavy risk incumbent in building a research program around a single individual. Because of the anticipated difficulty in recruiting experienced senior scientists, a less experienced but fully professionally qualified scientist would be considered for the station deputy position, perhaps a recently graduated Ph.D. He would assist the station director as directed in guiding and instructing the assistant scientists, particularly in his speciality area. The deputy would be expected to greatly facilitate the research program, since the station director would probably have heavy administrative and liaison responsibilities during the initial year.

The requirement for close C/JT for the assistant scientists is another important reason for funding a station deputy. On the job training is vital to the long range success of the Mopti program since the assistant scientists must become fully competent to continue meaningful rice research work when the expatriate scientists leave.

There is a high acknowledged risk factor in implementing a complex and costly research project under difficult circumstances, almost entirely dependent on the health and disposition of the station director. Having a second senior scientist would provide insurance that the research program would not become moribund should one or the other of the senior scientists not complete his assignment as expected.

With both scientists on the job, the research program could benefit greatly from continuity of supervision and training. While one or the other senior scientists was performing travel for essential liaison or study purposes, one would remain at the station. Also in a less definable way, reinforcing one senior scientist with complementary skills of a second seems to produce a synergistic result, enabling each scientist to be much more productive than he would be independently. Perhaps most

Importantly, a second senior scientist should greatly augment the capacity of the senior staff to plan and organize farmers field trials and to accelerate the application of research results to farmers fields. Either the senior scientist or his deputy would be responsible to organize the field testing and outreach programs.

3. Consultants.

The project provides \$76,000 to pay the travel and per diem and services of consulting senior scientists and international research institutions. On the assumption that consultants salaries would normally be paid by the parent institutions such as IITA and IRRI, such an amount should allow at least 50 days of senior level consultancy annually. (Reference "Technical Analysis" A.1.5.).

4. Agriculture Research/Extension Liaison Specialist. (See rationale and job function p.).

PART 3 PROJECT ANALYSIS

A. TECHNICAL ANALYSIS

A.1. Deep Water Floating Rice Research

1. Feasibility.

The long range potential for generating significant rice production increases in West Africa through deep water/floating rice research at Mopti depends on a) the prospect for achieving scientific advance in developing better rice varieties and practices and (b) the prospects for disseminating those varieties and practices. This analysis relates to the first point.

The broad objective of rice research at Mopti should be to develop varieties and cultivation practices in the form of "production packages" which are adapted to West African environments and produce higher yields than currently recommended varieties and practices under circumstances encountered by the small farmer. The scientific potential to achieve such packages at Mopti depends largely on the nature of the cultivation constraints being addressed and the success of primary rice research worldwide in addressing similar constraints.

Some degree of research work has been done on all important food crops and in recent years certain crops such as wheat, corn, and rice have been given special attention and through research, dramatic increases in

yields have been obtained. In the case of rice, most of the earlier attention was devoted to irrigated rice and more recently to upland rice. Floating/deep water rice has not received a proportionate share of attention because it is limited to fewer countries and less total area than the other types.

There is no reason to believe that significant increases in floating/deep water yields cannot be made if sufficient emphasis with scientists and resources is given. Research on floating/deep water rice can best be done under natural conditions in a representative area. It appears that the WARDA proposed Mopti/Mali project fits these conditions.

2. Deep Water/Floating Rice Cultivation.

The design team visited deep water and floating rice areas in Mali and Nigeria where the largest concentrations of this type occurs in the WARDA region. Detailed information on the cultivation of this rice type in Africa is limited largely to Mali where deep water/floating rice research and rice development have been on-going for several years.

Floating/deep water rice is sown on a dry land seed bed and grows for several weeks before flooding occurs. This requires rainfall for seed bed preparation, germination and plant growth in the early stages. The Mopti area is characterized by two main factors: 1. a period of rainfall and 2. a period of inundation due to overflow of the Niger River. The rainfall pattern is shown in the following table.

RAINFALL AT IBETEMI, MM's

Average			
Month	1947-1968	1972	1973
May	18.5	51.2	12.5
June	52.5	36.7	36.3
July	146.9	38.9	136.8
August	194.0	134.9	53.0
September	100.5	84.0	40.7
October	18.0	15.0	13.4
TOTAL	530.0	410.7	343.2

The rest of the year is characterized by a total absence of rain and relative humidity between 20-30% from January to May. The hottest part of the dry season is from the end of February to the period of first rains.

There is normally a period of about two weeks with no rain between the end of the main rainfall period and the beginning of the Niger River floods. During some years this dry period has been much longer and yields of rice were much lower than normal. On an average, the maximum flood stage is reached between October 15-30, and the bulk of the cultivated lands are submerged at a depth of between 0.3 and 2.5 meters depending on the fields' topography. The flood waters begin to recede the first part of December and the land usually becomes dry during January but in some years as late as February.

The annual variations in flooding are highly important and include: 1) Date flooding begins, 2) Rate of water rise (2-10 cm. per day); 3) Maximum water depth reached and 4) Date and rate of recession of flood water (same magnitude as water rise).

The land is worked for seed bed preparation only after the rains begin and after the soil has attained a moisture level sufficiently high for the cattle to be able to pull the implements through the land.

The animals used are native breeds, weighing between 300-400 kgs, relatively weak, and not able to work the land under adverse soil moisture conditions. This is a critical factor as the period of favourable soil moisture can be quite variable due to variability of rainfall.

After the final working of the seed-bed, usually in July, the rice is seeded, the seed germinated, and early stages of growth occur under existing rainfall conditions.

Under ideal conditions, rice plants are at about maximum tillering stage at the time the flood waters begin to inundate the land. If the flood waters arrive before the rice plants are sufficiently advanced in growth and the water level rises rapidly, as frequently it does, the young rice plants are deeply inundated and die. If the flood waters arrive late and cessation of rainfall occurs early, the rice plants suffer from low soil moisture and will die or be weakened to a point of not being able to withstand the rapid rising water and competitive vegetation that usually emerges during a prolonged period between planting and flooding.

3. The current State of floating/deep water Rice Research.

a. Worldwide -- Bangladesh, with the greatest area of floating/deep water rice of any country in the world has a modest research program dealing with this type of rice, even though primary emphasis is placed on irrigated and rain-fed types of rice. A relatively strong breeding program is being conducted with the objective of producing high yielding varieties of rice that have the ability to elongate only to the extent required by existing flood water levels and yet have the capacity to elongate rapidly and sufficiently to meet extreme conditions of flooding. Standard and traditional varieties have less flexibility in that they are adapted to fairly definite water depths and do not perform well in significantly lesser or greater depths. For example, a variety adapted to 6-8 feet water depth grows much taller than necessary if only a three feet water depth occurs, resulting in lower yields. Studies are also being continued in cultural practices suited to the new types of rice that are being developed. Emphasis is also being given to genetic resistance to insects especially stem borers which are reported to reduce yields up to 35% in areas of West Africa.

Thailand has a strong breeding program with emphasis, like Bangladesh, on developing high yielding varieties with the ability to "telescope" as required by existing water levels. A considerable amount of progress has been achieved to-date and some lines from Thailand are being tested in West Africa. Early results indicate good potential for higher yields even though further breeding for local adaptation is needed. These lines are especially promising for shallower depths of flood water. Research on rice insects, diseases; cultural practices, nutrition and etc. is simultaneously being carried on with floating/deep water rice.

In summary, research work has been carried out in several countries on floating/ deep water rice but in every case it has received secondary emphasis and resources. As a result only modest gains have resulted.

b. Mopti -- A floating/deep water rice research station was created in 1952 at Ebetemi, north of Mopti and on the opposite side of the river. Research initially consisted primarily of seed multiplication of selected varieties of floating rice, principally three varieties of *oryzae sativa*. Most of the rice under traditional cultivation was *oryzae glaberrima* with red grains.

A program was begun in 1960 to introduce, study, and multiply superior selections of floating rice with white grains that would progressively replace the traditional varieties of red rice. Optimum methods of culture were also studied. A collection of oryzae glaberrima were studied, characteristics catalogued, and preserved.

Between 1960-1965, several hundred varieties of rice were introduced to Ibeteni from Thailand, Pakistan, Vietnam and other countries. From the testing program, three new superior varieties were multiplied in 1965. Yields of from three-four tons/ha. were obtained under controlled conditions. During the same period a collection of oryzae glaberrimas was studied and superior varieties selected. In 1967 a maximum yield trial under irrigation and good fertilization to compare the best selected oryzae sativa variety with the best oryzae glaberrima variety under experimental conditions resulted in the glaberrima yielding 4.45 MT/ha. while the sativa yielded 3.14 MT/ha.

Crosses were made in 1964-65 between some of the new materials that had been collected. Irradiation of some selected varieties for mutation studies was begun in 1971.

Between 1965 and 1975 studies were conducted on cultural practices such as rates of seeding, spacing, rate of growth, different rates of water rise, depth of flooding, and response of different varieties of rice to fertilizer applications. During this period information was gathered on rice insects and control of these insects. Work was also carried out on identification and methods of control of competitive weeds. At present, one expatriate agronomist is working at the Ibeteni experiment station.

An appreciable quantity of both materials and information on the major problems in floating/deep water rice has been gathered and should be taken into consideration in future planning for increasing rice production in West Africa.

c. Nigeria

The most important zones for rice production in Nigeria are in the naturally inundated lowlands. Statistics are lacking but it is estimated that 40% of the total rice production in the country is from these areas where floating/deep water rice is adapted.

A floating/deep water rice experiment station with an area of 15 acres and staffed with one Agronomist and two Assistants is located at Birnin-Kebbi. Research is also carried out by senior scientists stationed at Bedeggi (the main rice experiment station), and at Moor Plantation and other institutions. A limited amount of research has been conducted on varietal improvement by collecting indigenous varieties, especially *oryzae glaberrima* for study; introducing varieties from other countries and comparing them with standard recommended varieties; hybridizing different varieties with desirable characteristics and testing new varieties against recommended varieties. Work has been carried out on cultural practices in studying the time and rates of seeding. Studies have been made on application of fertilizer to rice with emphasis on nitrogen application. Other studies have been conducted in the fields of weed control, physiology, entomology, nematology, pathology, rice nutrition, processing and utilization, and economics.

The present trend in Nigerian research appears to be towards placing more emphasis and resources on controlled irrigated rice in order to greatly increase yield per acre of rice. It is recognized, however, that floating/deep water rice will continue to be important.

4. Proposed Research Program at Nopti

It is proposed that research will be conducted in four major areas: Varietal Improvement, Agronomy, Weed Control, and Entomology. The areas of proposed research appear to be adequate to solve the immediate major problems of floating/deep water rice production which are:

- 1) Lack of a high yielding white grain varieties with the following characteristics: growth duration periods corresponding to the requirements of the different major areas of production, the ability to elongate rapidly as the water level rises, genetic disease and insect resistance, the ability to compete with existing weeds, strong grain dormancy to prevent sprouting before harvest, drought resistance during the early stages of growth in the period between the cessation of rains and arrival of flood water, and an acceptable cooking and table quality along with high milling yields.
- 2) Lack of economically feasible methods for control of competitive weeds, especially the wild rices.
- 3) Insufficient information on insects that damage floating/deep water rice and their control.
- 4) Limited information on improved cultural practices including double cropping of rice or second plantings of other quick maturing crops.

a. Research Targets

Individual targets for the four disciplinary areas of research might be defined as follows:

1) Rice varietal Improvement

Through introductions, collection of indigenous rices, and hybridization by the breeder along with the close cooperation and coordination with the agronomist, weed specialist, and entomologist all working as an integrated team, produce high yielding good quality floating/deep water rice varieties adapted to the various existing conditions in West Africa.

2) Weed Control

The weed specialist will develop economically feasible methods of controlling competitive weeds by all possible means such as chemical, biological, cultural, and other methods and shall work in conjunction with the breeder, agronomist and entomologist in an integrated approach to attaining the overall objective.

3) Agronomy

The agronomist will determine the optimum cultural practices for existing and new varieties that will be produced such as optimum dates of seeding, rates of seeding, method of seeding, seed treatment, schedule and method of land preparation, fertilizer applications, method of fertilizer applications, optimum flooding and drainage schedules. He will work in close conjunction with the breeder in yield trials and other factors that the agronomist can best contribute. Close coordination with the weed specialist will be required in determining the effect of cultural practices on weed competition and with the Entomologist on factors affecting damaging and predatory insects such as time of plowing, depth of plowing, time of planting, plant population, spacing and etc. The agronomist will also investigate the feasibility of using rapid growing crops following the main rice crop. He will work in an integrated team approach at all times to attain the overall objective of significantly increasing yields of floating/deep water rice in West Africa.

4) Entomology

a. The Entomologist will identify the insects that cause major damage to floating/deep water rice as well as predators that attack these insects and will determine economical means of control by chemical, biological, mechanical and other methods. He will work very closely with the breeder in determining genetic resistance of breeding materials and with the Agronomist on the effect of cultural practices on insect populations, life cycle of insects, and etc. The entomologist will work closely with the weed specialist in studying the effect of weed control practices on rice insects and especially on biological control of weeds. At all times the Entomologist will participate as an integral part of the research team in its attempt to reach the overall objective.

b. Research Workplan

While this "Technical Analysis" presents the research targets and general program of work, more detailed annual research workplans will be needed.

WARDA plans to have a team of rice research experts visit the WARDA regional research projects in the Spring of 1976 to review/recommend detailed research programs for each activity (Rokupr, Mopti, Bouake, Richard Toll). Similar teams of rice research experts will review the work of the different research projects at appropriate times during project implementation and recommend revision/modification of research targets and work plans as needed.

5. Research Backstopping; International Links.

The Mopti activity requires continuous scientific backstopping by the WARDA Director of Research who should make frequent visits to Mopti. Due to the isolation of Mopti from points of similar research and the omission of certain disciplines such as pathology, soil chemistry, soil microbiology, plant physiology and rice chemistry, it will be necessary to have individual specialists (for example rice virologist in the event that a virus disease suddenly appears) and institutions such as IRRI and IITA (for example, to make protein and amino acid analysis) to serve in backstopping the project. Funds have been provided in this proposal to support a minimum of ten days per discipline per annum or total of 40 days of specialist backstopping at minimum costs and as part of their outreach and feedback operations, and an additional \$10,000 per annum has been budgeted to pay for services such as disease analysis, etc.

Travel-study is necessary for Mopti scientists to visit other research centers to observe research work underway and to attend pertinent scientific meetings. The project purposes a minimum of one area travel-study per scientist per year; one area scientific meeting per year for each scientist and one international study-travel per year provision for the project, estimated at \$7,000 per annum.

The Mopti floating/deep water rice research project is designed to serve West Africa. Before research workplans are finalized, considerable amount of study should be given to the details of floating/deep water rice production in all concerned countries so that a clear understanding is formulated of the practices and the problems in the different areas. While some problems are similar in most countries they vary widely between others. Naturally, priorities have to be made but at the same time complete coverage to some degree should be planned. For example, a major need in Mali is for floating rice varieties of longer growth duration while Nigeria needs varieties of shorter duration. It will be necessary to carry out some of the research in other countries by a cooperative arrangement with research stations and individual scientists. WARDA has the organization and contacts to make arrangements of this type.

When various materials and methods begin to show promise in the early stages of research, these materials and methods should be placed under similar testing at other locations in the area for verification of adaptation. Upon early determination of superior materials and methods, they will be placed in WARDA regional trials for widespread testing and observation. Any materials and/or methods judged superior in the regional trials will be further tested in farmers fields by various agencies such as CRM in Mali, National Accelerated Food Production Program in Nigeria and other organizations in other countries. Funds has been provided in this proposal to permit the Mopti station to develop field trial plans and to initiate action with WARDA and other cooperating agencies to conduct these trials.

Strong links must be established between the project and all pertinent institutions outside the area such as the Bangladesh Rice Research Institute and Thailand's Rice Improvement Organization to facilitate a flow of ideas, information, and materials. Especially important are IRRI and IITA. These two institutions are staffed with outstanding specialists in their fields and the greatest single sources of materials and information are available from them. These institutions are the best source of assistance in training at several different levels. IRRI and IITA also have the staff and equipment that would make possible certain services

such as anylose and protein analysis and specialists that would be available for assistance in problems that the Mopti staff might not have the necessary capability to cope with, such as virus diseases and damaging nematodes. WARDA maintains good working relations with these institutions and should find no difficulty in coordinating the necessary backstopping for Mopti, as well as other WARDA regional activities.

A.2. ENGINEERING AND CONSTRUCTION

1. Existing Infrastructure

In operation since 1962, the Icetemi station has displayed several technical deficiencies including: 1) high elevation; 2) late flood arrival; 3) slow water rise; 4) lack of needed water depth (not over 1.3 meters) and 5) insufficient experimental plots and 6) insufficient pumping capacity. These features make it an unrepresentative site for deep water/floating rice research.

To overcome these deficiencies and to permit the necessary adaptive rice research needed to backstop the huge ORM rice development programs, the basic infrastructure of a new experimental station and seed multiplication farm (the Mopti-North station) was constructed under the ORM project between 1971-1974. The new station infrastructure was well designed and constructed. The cultural conditions (soil, water depths, etc.) appear to be representative of the area and very suitable for rice research.

At the present time, the Mopti North station consists of 105.5 ha.-- a 55 ha. seed multiplication farm surrounding a 50.5 ha. experimental farm of which 46.5 ha. is subdivided into four experimental plot sub-polders;

- sub polder for deep water rice, 6 ha.
- sub polder for shallow floating rice, 9 ha.
- sub polder for deep floating rice, 14 ha.
- sub polder for very deep floating rice, 17.5 ha.

The principle dikes, canals, sluices and the buildings area and several buildings have been completed.

The station has its own flood water system through gravity feed from the river and the water level can be controlled separately for the four subpolders.

Buildings already completed at the Mopti North site include:

- | | |
|---|-------|
| 1. One villa for the station director (19.65 x 14.7 meters) | WARDA |
| 2. One triple shed (12.75 x 18.00 m) | WARDA |
| 3. One laboratory with office space (9.0 x 10.5 m.) | WARDA |
| 4. One open workshop with storage room (4.2 x 15 meters) | CRM |
| 5. One shed for storage of machines, fertilizer, chemicals, etc. (24 x 10.5 m.) | CRM |
| 6. Two office buildings (6.2 x 16.65 m.) | ORM |

Some of these buildings are for the use of the seed multiplication facility to be operated by CRM. The Malian Institute Economie Rural and WARDA will insure cooperation between the CRM and the Mopti-North station in sharing facilities and equipment.

The total value of land development empoldering and other infrastructure existing at or in support of Mopti-North is valued at about \$342,000.

In addition, CRM has a budget for farm equipment personnel and operating for the seed multiplication operation.

2. New Infrastructure

Some additional explanation follows regarding the rationale for certain elements of the infrastructure development.

a. Guest house -- The guest house is considered to be vital input to the successful operation of the research program. As discussed under the research analysis above, scientific consultants will be vital to provide specialized research knowledge and direction for certain aspects of the program. Public guest facilities are so poor in Mopti as to preclude senior scientists from visiting for longer than a few days or for a second visit. Since frequent consultancies are required, adequate guest facilities are also required.

b. Staffing house -- As an economy move and in anticipation of some attrition among assistant scientists and the future absence of other assistants for further academic training, provision has not been made to construct housing under this project for each of the additional assistant scientists to be trained for Mopti. Doubling up, use of the guest house and renting on the local economy provide safety valves if housing should be temporarily short at the station.

c. Housing site -- The housing area donated by the Government of Mali requires extensive foundation development and embankment in addition to driveways, fencing, a guard house and electrical generator facilities including a small generator house. Funds have been provided for that purpose.

d. Station buildings -- The additional buildings to be constructed at the Mopti-North research site (office, three laboratories with office space, green house, one screen house, one threshing floor, one generator house and one guard house) comprise the minimum essential office space and working area required. Because of the unreliability of the Mopti city supply, reportedly not operational for three of four months from July through October 1975, electrical generating capacity is justified.

e. Equipment -- Besides electrical generators and water pumps for the irrigation system, agricultural equipment, laboratory equipment, office equipment and transportation equipment will be needed to complete the physical infrastructure development. Equipment needs have been carefully considered by WARDA and the GCM and closely reviewed by the AID agricultural engineer and the rice research scientist on the project design team.

1) Farm equipment -- The type of farm equipment to be purchased will generally be of medium to light configuration, highly flexible, and appropriate to relatively small farm experimental operation. The CRM seed multiplication operation has heavy tractors available on a loan basis, although these would not be free during peak demand periods.

2) Laboratory equipment -- A lump sum of 370,000 is budgeted for laboratory equipment for the six scientists. This is a fairly conservative figure which along with provisions for physical contingencies is hoped to be sufficient for the basic items required.

Specifying and ordering the appropriate laboratory equipment requires careful consideration. It would be impractical to make a detailed laboratory equipment list prior to the development of the detailed research workplans. Also, the preferences of the individual scientists, particularly the station director and deputy, are very important. Hence, to enable timely ordering of essential laboratory equipment and early commencement of research activity, the following procedure has been incorporated into the implementation plan:

1) For limited amounts of highly sophisticated - high cost equipment that may be needed at some point in the project, arrangements should be made with an institution such as IITA, that may have the needed equipment, to perform the necessary analysis or test. 2) After the detailed research workplans have been developed, IITA will be requested to draw up lists of minimum essential equipment including cost estimates in light of their recent purchases and experiences. These lists would be used by the GCM and WARDA to solicit quotes and order the minimum essential equipment ordered.

3. Project Costs.

Construction costs have been estimated and verified by REDSO/WA/ENCR from square foot and cubic foot costs based on recent land development and building construction costs at Mopti North. Construction costs of housing and offices is estimated at \$232 sq. meter. Cost estimates should be reasonably accurate, after adjustment for inflation, since the type of buildings planned for the Mopti North site are of standard design and nearly identical to those already constructed there. Imported equipment costs (farm equipment, pumps, etc.) have been verified by recent quotations with allowance made for transportation and insurance.

Station operating costs are based on GCM salaries and costs at Ibetemi. Engineering design and construction supervision costs were obtained directly from the Genie Rural and appear to be considerably lower than would be the case if these services were provided by private contractor.

4. Engineering Planning, Supervision.

Overall responsibility for the construction aspects of the project will rest with the Rural Engineering Division (Genie Rural) of the Ministry of Rural Development which has more than twenty years experience in such work. The Genie Rural will provide the final engineering design, contracting services and construction supervision.

a. Design -- Existing preliminary plans and blueprints and recent construction experience at the Mopti North Station (1971-74) provide a sufficient basis for certifying the soundness of the engineering design and establishing reasonable cost estimates of the planned infrastructure development. A schematic drawing exists of the current station layout and topography, with some of the planned buildings also shown. Blueprints exist for the buildings already constructed at the site and standard Government of Mali blueprints exist for most of the additional buildings planned (laboratories, offices, houses, toolsheds, etc.). Complete engineering plans and specifications for the scientists' housing

area must be developed by August 1976 and contracts let by April 1976. If the housing foundation is prepared prior to the 1976 flood season, the houses can be constructed in 1977 (year 2). Final engineering planning to be accomplished by August 1976 includes: 1) updated skematic layout of the buildings areas; 2) a refined station irrigation plan and 3) finalized blueprints and specifications for each building. (See PPT Subnetwork, "Mopti Construction and Installation Tracking" Table 13.)

b. Construction Supervision -- The Genie Rural will act as agent for the Government of Mali and WARDA in supervising construction including inspection, measurement, interpretation of the plans and specifications, interpretation of the contract provisions, approval of materials, workmanship, work progress, satisfactory completion. On major questions or changes, the Rural Engineering Division will discuss with the Grantee WARDA and expedite WARDA's decisions. The arrangement for construction supervision will be negotiated between WARDA and the GCM as part of the WARDA-GCM agreement.

c. Contract procedures -- Contracts for the construction of project offices, houses, stores and garages are probably not suitable for U.S. bidding due to the dispersed location of the work and the relatively small size of individual contracts. Bids will be awarded by GCM bidding procedures and approved by WARDA and USAID/L. USAID/L will rely on REDSO/WA/ENGR in appraising specifications, tenders and award of contracts, and final construction.

A.3. ENVIRONMENTAL IMPACT

The rice research program planned at Mopti would have negligible environmental impact. Fertilizers and other chemical products will be used in small quantities for experimental purposes. The weed and pest control research will emphasize non-chemical control measures since chemical control is generally considered to be too high cost in most of the Sahelian-Sudanian zone to be economically viable for small farmers.

While the research program itself will have insignificant environmental impact, there are long term environmental implications related to the subsequent application of varieties and practices developed at Mopti. A potentially significant environmental issue related to deep water/floating rice cultivation is the incidence of schistosomiasis. As part

of its support to the Operation Rice Mopti project, the World Bank financed a study in 1971 of the potential impact of CRM rice development activities on the health conditions in the project area.^{5/} Conclusions of the study were that schistosomiasis was an important health problem, ranking fourth in the Mopti, Mali region after malaria, amebiasis and cholera. The disease is common all along the Niger River and 50% of the population have been estimated to have schistosoma haematobium infections.

Chemical control was considered of little value given the lack of water control and the tremendous costs. There is virtually no chance of reducing water contact or water pollution by any available means. The IBRD and the Government of Mali decided on an approach to snail control involving the gradual elimination of water holes where the bulinus snail populations survive in the dry season.

In preparation for continued support to Phase II of the CRM, project, which begins in 1978, the IBRD will be conducting an appraisal of the project in early 1976 including an assessment of current health conditions and the results of the snail control measures.

In addition, research on schistosomiasis control is currently underway in other parts of West Africa. The Schistosomiasis Control Pilot Project in Wa, Ghana, and Accra, Ghana includes control in man-made lakes (including Lake Volta and Lake Nassar). There are nine other separate control projects being implemented in eastern and southern Africa.^{6/}

On a global scale, the Edna McConnell Clark Foundation acts as a catalyst in (1) developing the means (thru research) to control schistosomiasis; and (2) stimulating and assisting governments of affected countries and major international and bilateral agencies to undertake schistosomiasis control efforts on a systematic and meaningful level. In this field, legislation specifying responsibilities of landowners and governments in regards to controlling schistosomiasis may offer an approach to financing of control programs; and legislation of varying degrees exists in six African countries: Chad, Egypt, Madagascar, Niger, Rhodesia and Senegal.^{7/}

A "Strategic Plan for Research" is the guiding document behind research project funding by the Foundation. Certain elements of the

^{5/} Appraisal of the Mopti Rice Project, Mali, Nov. 9, 1971, IBRD.

^{6/} Proceedings of a Symposium on the Future of Schistosomiasis Control, Feb. 1-6, 1972. Edited by Max J. Miller. Tulane University, 1972.

^{7/} Schistosomiasis Research: The Strategic Plan; June 1975 Edition. Donald B. Hoffman, Jr. Vice President, The Edna McConnell Clark Foundation, New York.

plan has been supported by the World Health Organization, the Rockefeller Foundation and A.I.D. as well as private business firms (i.e. pharmaceutical firms for vaccine and molluscicide research). The plan articulates and prioritizes the research required to achieve the four major research program goals which are aimed at providing the means to control schistosomiasis, i.e., to halt its spread and reduce incidence, prevalence, ^{8/} morbidity and mortality with emphasis on eliminating clinical disease.

^{8/} Ibid.

III. Project Analysis (continued)

B. FINANCIAL ANALYSIS AND PLAN

1. Financial Plan/Budget Tables

The total five-year financing estimated to carry out the Mopti activity and the projected sources of this financing are shown in Table 2, "Summary Cost Estimate and Financial Plan."

During the development period of the project, the total project financing for foreign exchange and local costs will be provided by AID (\$2,460,900) and the Government of Saudi Arabia (\$300,000).

2. Financial Rate of Return/Viability

Indicative analysis of the financial effect of the project on beneficiaries is presented in the Economic Analysis, C.5.

3. Implementing Agency Budget Analysis

a. Implementing Agencies' Contribution --

While WARDA's development budget is financed entirely by donors, its operations budget for the Executive Secretariat is largely funded by member nation contributions. Member nations including Mali have demonstrated a strong commitment to WARDA's operations through full and prompt payment of their assessed contributions.

WARDA's Executive Secretariat is responsible to administer the Mopti activity implementation. The Secretariat has already allocated considerable time and resources to Mopti activity planning and design, and will provide further management and scientific guidance as required for implementation. About 12-18 man months of senior management, research and extension services will be required of the Secretariat over the initial three year development period, valued at roughly \$40,000.

The Government of Mali is contributing the existing station land and buildings infrastructure at Mopti North, valued at an estimated \$340,000; research coordination and direction by the IER, and close scientific collaboration and direct support of field trials and outreach programs by the ORM.

b. Budget --

WARDA's operating budget is expected to exceed \$4.5 million in CY 1976. Contributions from member countries was \$497,737 in CY 1975 and is expected to reach \$577,296 in CY 1976. Under pressure from UNDP, WARDA is attempting to meet the administrative costs of running the Secretariat from member country contributions. The Consultative Group for International Agricultural Research (CG) was WARDA's second largest single donor in 1975 with a

grant of \$575,000; the U.S. grant was for \$737,000. The CG contribution in CY 1976 is expected to exceed last year's level. Meanwhile, UNDP has recently approved Phase II of its assistance to WARDA for the period July, 1975, through December, 1977. The amount of this support was \$1,167,000 but recent cutbacks by the UNDP will reduce this figure somewhat. Other donors that have pledged assistance in CY 1976, excluding USAID, are France (\$62,910), Switzerland (\$46,000), Saudi Arabia (\$300,000 over a three year period), the United Kingdom (also \$300,000 over a three year period), Nigeria (an unspecified amount) and Liberia, (which provides free of charge the office space and utilities for the Secretariat). Other potential donors include Canada (to support the Richard Toll/Fanaye research activity) and the Netherlands.

WARDA's financial management competence has been discussed in the PP and has been demonstrated during implementation of the AID grant.

c. Recurrent Financing --

While the overall funding of WARDA regional programs seems well assured over the project development period, assuring needed financing beyond the five year project development period is a matter of less certainty. Cereal research is long term research with concomitant long term financing implications. Member nation subscriptions are expected to cover the Executive Secretariat's operating costs from 1977 on, but the regional research activities, such as the WARDA-Mopti Activity, will continue to require external donor financing for the foreseeable future. Following the departure of the senior expatriate scientists at about the end of FY 1980, recurrent Mopti-North Station operating costs should be approximately \$200,000 to \$250,000 annually.

For purposes of this project proposal, it is assumed that a successful regional rice research program at Mopti-North will attract the necessary national, regional and external donor funding to permit the continuation of research. Over the past decade or so successful or promising international research institutions have been able to rely heavily on external donor financing to support continuous high levels of research activity. Future long term trends in the level of external funding are not clear, however. On one hand, the strategies of major international donors and institutions place increasing emphasis on support to international and regional food crop research. But liquidity problems have apparently recently induced certain major international donors to reduce their projections for future international research support.

The Consultative Group for International Agricultural Research (CGIAR) is the principal international funding source for international research and a major donor to WARDA. Future CGIAR funding is anticipated, contingent on WARDA's demonstrated achievement of its rice research and production objectives.

To encourage a continued high level of financial planning and fund raising for WARDA's regional research activities, the Grant Agreement will include a "Covenant" regarding the obligation of WARDA to undertake the necessary planning and coordination in conjunction with the GOM to generate continued national, Africa-regional and international funding for the WARDA-

Mopti activity at the end of the project development period. As with all food crop research projects, AID should anticipate requests for additional U.S. assistance beyond the initial development period.

Suggested language for the covenant follows:

The West African Rice Development Association agrees to undertake, in conjunction with the GOM, vigorous planning and coordination toward the objective of assuring adequate financing from Malian government, Africa Regional (WARDA) and external donor sources for the continuation beyond the five year development period of regional and related national rice research and outreach programs centered at the Mopti-North Rice Research Station.

TABLE 2.

45.

SUMMARY COST ESTIMATE AND FINANCIAL PLAN
(US \$ 000)

WARDA-MOPTI PROJECT PAPER AMENDMENT

Source	AID		Host Country		Other(s)+ Saudi Arabia		Total
	Total		Total		Total		
<u>Investment Costs</u>	<u>794.4</u>				<u>200.0</u>		<u>994.4</u>
Construction	652.8				127.2		780.8
Equipment	141.6				72.8		214.4
<u>Operational Costs</u>	<u>1,145.6</u>		<u>1/</u>		<u>96.5</u>		<u>1,242.1</u>
Technical Assistance	552.0				96.5		552.0
Other	593.6				96.5		690.1
<u>Participant Training</u>	<u>254.0</u>				<u>0</u>		<u>254.0</u>
<u>Inflation Factor</u>	<u>211.1</u>						<u>211.1</u>
<u>Contingency</u>	<u>55.9</u>				<u>3.5</u>		<u>59.4</u>
Total	<u>2,461.0</u>				<u>300.0</u>		<u>2,761.0</u>

1/ WARDA contribution in kind consists of administrative services valued at approximately \$40,000 (18 m/m senior management and scientist services). Mali contribution in kind (land plus research station infrastructure) is valued at about \$342,000.

TABLE 3

COSTING OF PROJECT OUTPUTS/INPUTS
(\$000 or equivalent)
Project Paper

XX New
Rev # 1/

Project # 698-11-190-382Title Rice Research and Production

Project Inputs	Project Outputs				TOTAL
	# <u>1</u> ^{<u>2/</u>}	# <u>2</u> ^{<u>3/</u>}	# <u>3</u> ^{<u>4/</u>}	# <u>4</u> ^{<u>5/</u>}	
AID Appropriated	622.0	385.5	1284.5	196.0	2461.0
Other U.S.					
Host Country Note: WARDA contribution consists of administrative services valued at approximately \$40,000 (18 m/m senior management and scientist services). Mali contribution in kind (land plus research station infrastructure) is valued at about \$342,000.					
Other Donors*	65.7		234.3		300.00
<u>Total</u>	<u>687.7</u> ^{<u>6/</u>}	<u>358.5</u> ^{<u>7/</u>}	1518.8	<u>196.0</u> ^{<u>8/</u>}	2761.0

1/ This breakout of project output/input cost pertains to the WARDA-Mopti activity.

- 2/ Output #1 is "Research (experimental) program"
- 3/ Output #2 is "Trained African Scientists"
- 4/ Output #3 is "Established research facilities"
- 5/ Output #4 is "Field trials/outreach program"
- 6/ Calculated from operating costs (\$548,000) minus \$37,000 (output #4) minus 157,000 (output #2)
- 7/ Calculated from cost participant training (70,400) plus 20% of T.A. costs.
- 8/ Calculated from the salary of the research/extension/liason expert plus 40% of the station deputies' salary.

C. ECONOMIC ANALYSIS 1/

1. Regional Overview

Economic analysis of the WARDA/Mopti rice research proposal must be performed within the context of its possible contribution to the goal of WARDA's overall program -- to assist the West Africa Region and individual WARDA member countries to an improved rice economy through increased and more efficient rice production and marketing. It is useful to recall some of the important features of the West African rice economy which gave rise to the establishment of WARDA, and its general and special project activities.

Rice accounts for only about 12 percent of the total cereals production within the WARDA region (see Table 4), but for some countries and localities rice is the major crop. Fifty-nine percent of the cereals produced in Gambia, 69 percent in Ivory Coast, 95 percent in Sierra Leone, and 100 percent in Liberia is rice. Rice is also of paramount importance in some regions of most other WARDA countries, notably the Niger delta region of Mali.

Similarly, although rice consumption averages only about 13 kilograms per capita in the region, it is the major cereal consumed in Sierra Leone, Liberia and Gambia and in some regions of the other countries (Table 5). It is the preferred cereal in urban centers throughout the region. Concurrently with population growth and increased urbanization between 1960 and 1974 annual rice consumption in the WARDA countries increased from about 890,000 to 1,580,000 metric tons. Per capita consumption increased from 10.3 to 13.2 kilograms.

Unfortunately, rice production has not kept pace with consumption increases in most WARDA countries. Total regional production has risen from an average of between 600,000 and 730,000 metric tons of milled rice in 1960-1964 to about 1 million metric tons in 1970-1973 (Table 6). Imports necessary

1/ This analysis and its supporting tables are taken from the report prepared by Thomas E. Davis, Agricultural Economist, Project Design Team.

to meet the consumption-production gap in WARDA countries increased from an average 276,000 metric tons in 1960-1964 to 582,000 tons in 1973 and 594,000 tons in 1974. The cost of imports increased from \$32 million in 1960-1964 to \$143 million in 1973 and \$235 million in 1974 (Table 7).

Some countries have been particularly affected by increasing rice deficits. Mali, which exported rice in the early 1960's was only 44 percent self-sufficient in 1974. Senegal and Upper Volta also had more than 50 percent reductions in their self-sufficiency ratio. For Senegal, rice imports averaged 36 percent of all imports during 1970-1974, and cost 31 percent of all export earnings in 1974. In the same year, Sierra Leone used 16 percent of its export earnings to buy rice. In 1973 rice imports by Mali, Senegal and Sierra Leone accounted for 21 percent, 26 percent and 28 percent, respectively, of those countries foreign trade deficits.

2. Importance of Deep Water and Floating Rice

The area devoted to rice production under deep water and floating conditions in West Africa is estimated to be about 340,000 hectares (Table 8). Of this total, 71 percent is located in the Niger River inland delta region of Mali, 150,000 hectares, and in the Slushin and Birnin Kebbi regions of Nigeria, 90,000 hectares. Although the deep water/floating rice areas in some of the other West African countries are not large relative to those in Mali and Nigeria, they are important in relation to the total rice areas within these countries. Deep water/floating rice occupies 66 percent of the total rice area in Niger, 64 percent in Gambia, 54 percent in Dahomey and 42 percent in Mauritania. For the total WARDA region deep water and floating rice areas comprise 23 percent of the area devoted to rice culture. Estimates of the amount of rice produced under deep water and floating rice yields are, in general, higher than upland yields. It is probable that deep water/floating rice now accounts for, at a minimum, one-fourth of the rice produced in WARDA countries.

The total area with potential for deep water/floating rice production in the WARDA region is estimated to be about one million hectares (Table 8). Expansion to the level would result in deep water/floating rice on about one-half of the regions rice land. Although rapid expansion of deep water/floating rice areas is certainly not to be expected, expansion of land in this type of rice can probably occur much more rapidly than can either upland or fully irrigated rice areas, both of which will require relatively high levels of purchased inputs (fertilizers) and, for irrigated rice, capital intensive infrastructure. Likewise, labor quantity and quality ^{are} limiting factors for any type of rice area expansion, but most importantly affect irrigated rice.

3. The Niger River Basin

Mopti lies in the heart of the Sudanian-Sahelian zone on the Niger River. The 4000 kilometer long river encompasses the single most important surface water resource in the West Africa Sahel and the key to the development of the region. The "Interior Delta" region of the Niger, where Mopti is situated, benefits from highly regular annual flooding and has potential as a vast

Sahelian granary. "With approximately one million hectares inundated each year in the Interior Delta, the potential for crop production, mainly deep water rice, appears to be at least one-half million hectares" ^{2/}. Most rice growing in this region is traditional deep water/floating rice cultivation using native Glaberima varieties under uncontrolled or partially controlled water conditions.

While long range planning and development of the Niger is only now being seriously begun, studies to date have clearly indicated that flood irrigation and the deep water/floating rices will remain important over large areas of the Interior Delta. Even where large river diking and flood control schemes are planned or underway, deep water/floating rice remains of primary importance. The decree of water control introduced in the deep water areas serves to reduce the elements of risk involved in the timing and speed of rise or fall of the flood rather than to reduce maximum water depth.

With irrigated rice development so costly, it may prove economically efficient to produce more of West Africa's rice needs through expanded deep water/floating rice cultivation. While the opportunity costs of land and water are relatively low for deep water/floating rice cultivation (only this crop can be grown in the large areas of deep and relatively uncontrolled water), the opportunity costs of irrigated rice development are higher. If more of West Africa's rice needs were met through deep water/floating rice cultivation, this might free land, capital and water resources which would have been applied to irrigated rice development. Particularly in the Sudanian-Sahelian zone where water is generally an important constraining factor, water resources thus freed might be economically allocated to other irrigation schemes less water intensive than irrigated rice.

4. Beneficiaries

Statistics enumerating the families or persons dependent on deep water or floating rice for all or part of their subsistence are not available. However, a minimum estimate can be derived. If all the deep water/floating rice were produced in subsistence plots, each hectare would provide cereal grain for about four people -- assuming a yield of 900-1,200 kilograms per hectare and per capita consumption of 260 kilograms (unmilled rice). The 240,000 hectares now in deep water/floating rice would support 1.4 million persons, or 175,000 eight-member household units. Probably several times this number of people are involved in deep water/float-ng rice production, because most of these farm families are also engaged in other food production activities such as growing other food crops, fishing or cattle raising. The potential expansion of deep water/floating rice area could directly involve more than 5 million people, most of whom are at the extreme bottom of the economic ladder. An even larger number would be indirectly affected through secondary employment, food availability, price, and general welfare effects, provided of course that the rate of increase in rice production exceeds the

^{2/} Development of the River Niger Basin, IBRD, June 1975.

the rate of increase in population.

5. Need for the Deep Water/Floating Rice Research

Recognition of the current and potential importance of deep water and floating rice to the West African rice economy is reflected in the WARDA proposal to sponsor regionally important deep water/floating rice research at Mopti, similar to the WARDA sponsored research on irrigated rice at Richard Toll, Senegal, and on mangrove swamp rice at Rokupr, Sierra Leone. Upland rice research results produced at research stations at Ibadan, Nigeria (IITA) and at Bouake, Ivory Coast are also being made available throughout the region with WARDA's assistance.

An implicit assumption underlying the WARDA/Mopti proposal is that improved varietal and cultural packages for the various deep water/floating rice areas in the West Africa region are needed and that the project can be designed so as to assure development of the necessary packages within a reasonable time span. In this context it should be recognized that research already completed at Mopti by IRAT, at Birnin Kebbi and Badeggi in Nigeria by Moor Plantation, and at various sites throughout the region by WARDA's coordinated trials program has produced results which promise increases in farmer's yields ranging from 200 to 400 percent, if the selected or improved varieties and cultural practices are made available and used by farmers.

The existence of high yielding varieties or practices not now used by farmers would seem to indicate that additional basic research is not needed to attain short run yield improvements. However, some characteristics of the results available may explain why they are not being used. First, no trials in farmers fields under the conditions which farmers face have been conducted and cursory examination of research results reveals that much of the apparent potential exists only under somewhat better than average conditions. For example, among weaknesses of the available improved (Sativa) varieties are inability to survive either extended dry periods or too rapidly rising flood water. Native (glaborima) varieties are superior in these respects. Moreover, good results with the improved varieties are achieved only when substantially better management and more labor inputs are applied than normally used by traditional farmers. Also there is some evidence that increased levels of disease and insect control are required by the new varieties.

The above does not argue that no progress has been made, but that break-throughs of major practical usefulness require further adaptive research using information already gained. At the same time, efforts to extend the available results where they will be useful should be encouraged. Farm level trials are needed for research purposes. They might also result in the beginnings of a change in farmer's attitude with respect to management practices and willingness to apply labor and other inputs -- a change which will undoubtedly be the key to major production increases, whatever research results are obtained.

6. Net Economic Effects

For a number of reasons, good estimates of net economic benefits attributable to the proposed research project cannot be calculated. The

nature and timing of research results cannot be predicted with accuracy. And, more importantly, application of the results will be largely out of the hands of the research staff. Furthermore, a multitude of economic, social and political factors affect the applicability as well as the application of results achieved.

Nevertheless, an admittedly hypothetical assessment of possible economic effects of the project can be done and should show a positive balance. The following analysis is based upon data, research results, and analysis furnished by various members of the Government of Mali and IRAT research and extension staffs at Operation Riz Mopti and Operation Riz Segou, both in the Niger inland delta of Mali. The analysis should be considered indicative of:

a. Returns to Farm Families --

The following discussion characterizes a normative traditional farm in the improved (poldered) areas of Mopti, Mali and evaluates the economic feasibility of its adoption of improved practices. Appendix Tables 10 and 11 summarize abbreviated farm budgets upon which the discussion is based.

A traditional farm located within or adjacent to the poldered deep water/floating rice areas in Mali typically has four hectares of rice, a work force of three adult males supporting a total of eight family members. Farm equipment consists of simple hand tools, primarily for harvesting, and a pair of oxen with plow. Total investment for the farm is about \$270, and no purchased seed or chemical inputs are used. The farm, upon adopting improved practices now recommended by operation Riz Mopti extension workers, mechanizes all farm operations (with animal power), uses fertilizer and improved seed, and increases total farm investment to \$935.

Production on the traditional farm is 4.9 metric tons of unmilled rice (1235 kg/ha) of which 2.5 tons is marketable surplus after seed and home consumption needs are met. After improved practices are adopted, total production increases to 13.8 tons of rough rice (3450 kg/ha). The marketable surplus is 11.7 tons.

Net cash and non-cash returns to the farm operation under traditional conditions are \$374. Under improved conditions net returns are \$953. Cash costs increase from \$13 to \$218 with improvement, and net cash income increases from \$213 (\$27 per household member) to \$860 (\$108). Net cash and non-cash returns per labor day increases from \$0.97 -- the unskilled wage rate in the region is about \$1.15 per day - to \$2.00.

At an overview level it appears that adoption of the improved practice package would surely be economically rational from the farmer's viewpoint. He would be able to increase net cash and non-cash returns to his farm enterprise by more than 150 percent and net cash income by more than 300 percent. Moreover, he would lift his labor return from below the regional wage rate to almost twice that level, and all this could be accomplished without large increases in labor inputs.

However, there are several reasons why farmers are not rapidly adopting improved practices and why it may not be rational for them to do so. First, of course, is the relatively heavy investment necessary. Traditional subsistence farmers typically do not have rich relatives; other private lenders would be obliged to charge ruinous interest rates to cover the risks involved, and the government credit available is limited and not particularly attractive. The current government credit at Operation Riz Mopti calls for a minimum 50% down payment for equipment purchases (sold by the government) with full payment of the balance due at the end of the first crop harvest for some implements, after three harvests for others. Furthermore, acceptance of government assistance obligates the farmer to sell a substantial part of his production to the government to the government marketing agency instead of in the so called parallel market where prices are usually better. Perhaps more important than economic reasons are the farmer's limited management capabilities and inclination, and the pressures of tradition.

Further increases in the yield potential and/or decreases in investment or cash costs under improved practices that might be developed through further research could affect farmers' willingness and ability to break with tradition. For example, assume a 50 percent yield increase with no increase in costs to the farmer. (Such an increase is certainly possible as yields of around eight tons per hectare have been achieved in the test plots). The output of traditional farmers would not be affected, because even should they purchase improved seed, substantive yield increases would require improved management and changes in other inputs used.

A 50 percent yield increase on the improved farm would increase output and the marketable surplus by 6.9 metric tons valued at \$635. Net returns to the farm would increase by 66 percent net cash income by 74 percent. Net cash income per household member would rise to \$186. Net cash and non-cash returns would be \$199, almost double the current per capita gross product for the country. Most important, the increased cash income gap between traditional methods and improved methods would be both a strong inducement to change and a reduction in the risk of making a successful jump from traditional methods.

b. Total Returns to the Project --

Adoption of improved practices (with a 50 percent higher yielding new variety) on only one percent of the 340,000 hectares now in deep water/floating rice production would yield net returns and net cash income increases totalling about \$1 million per year -- which is about equal to 40% total initial investment by the project. A higher adoption rate or expansion of the area in production would of course multiply this result many times. Certainly this type of result can not be assured, nor could it all be attributable to the WARDA/Mopti project were it to occur. But, the project might enable changes of this order of magnitude.

7. Socio-Economic Research

Socio-economic research to define non-technical limits to rice production and productivity increases is perhaps equally as important as the technical research planned. As field trials become more sophisticated they should be related as much to micro-economic and social constraints at the farm level, as to technical constraints. ORM is funded to conduct social-economic rice studies in the ORM area. The WARDA-GOM agreement does provide for the integration of Mopti North field trials and ORM. Such research might also identify the cultural factors and interrelationships acting as a brake on changes in attitudes and practices in the economic sphere of the farming sector.

8. Outreach of Research Results

a. Background -- As emphasized in the original PP, the dissemination and application of research results is essential to purpose achievement. In practice, however, research to outreach linkages are extremely undeveloped in West Africa.

Although national extension services exist in each of the WARDA countries, they are typically inadequately funded, staffed (quantity and quality), and managed. Also, West African extension programs are generally fragmented into projects focusing on particular projects in particular areas. Other than the Riz Segou and Riz Mopti projects in Mali which have a deep water/floating rice focus, there does not appear to be a current interest at the development or extension level in this type of rice culture. National governments express more interest in high investment projects to obtain full water control irrigated conditions.

Furthermore, WARDA's current capability and apparent commitment to extension of research results cannot be expected to insure rapid dissemination of research results to the farmer level. WARDA's organization chart includes one extension position out of about 50 professional positions. At present, WARDA's direct extension responsibilities relate to coordinated research trails at various locations in member countries. WARDA and the national governments continue to place emphasis on training extension workers but few direct links exist between research and these trained extension workers. Little follow-up exists to guide national governments and trained extension agents in organizing outreach programs incorporating recent research innovations.

b. Mopti-North Outreach -- Direct Mopti expenditures for "outreach" activities represent a relatively small portion of overall activity costs. But ensuring the applicability of research results to farm conditions and ensuring the application of results to farmers fields was a major design team concern.

Basically, the Mopti activity calls for several interventions and linking mechanisms to augment the research to outreach gap:

1) At the Mopti station, the station director or deputy is to allocate substantial time to the conceptualization and direction of farmers field trials in conjunction with ORM and Nigerian agencies particularly at

at Birnin Kebbi.

2) Also at Mopti, an assistant scientist will be trained as a agriculture research/extension liaison expert and assigned to work with the Mopti station director on farmer field trials and outreach programs.

3) At WARDA headquarters, WARDA will assign an extension specialist to coordinate with the Mopti and Rokupr stations to work with national extension and research directors to test or apply the results being generated through regional research.

4) The WARDA-Mopti activity proposal is greatly enhanced by the on-going rice production programs of the huge "Operation Riz Mopti" (ORM) project centered at Mopti.

ORM offers good immediate prospects and means for field testing research results and translating those results into production benefits. Financed by the IBRD, FAC and the GOM for more than \$10 million in Phase I (1972-1977), the project has progressed well in empoldering rice growing areas and introducing partial water control, new technologies and production organization on 30,000 ha. in the target area. Phase II of the ORM project (1978-1982) is expected to double the affected area. The WARDA-GOM agreement provides for two types of close ORM outreach collaboration: a) Farmers field trials using Mopti developed methodologies and packages and b) Integrated ORM social-economic research.

In discussing outreach, one caveat is in order, there can be no effective outreach until research has produced results worth testing or applying.

Even though significant new research results cannot be expected before year four, the field trials should be planned in year one and installed in year two to test existing lines and practices.

9. Pricing Policies

Rice production and productivity in West Africa may be restricted more by low producer prices rather than by inadequate varieties, input supplies, or management-labor resources. The effective demand for rice is not known in the WARDA countries most seriously affected by increasing rice deficits. Consumer prices in Mali, Senegal and Sierra Leone are maintained by Government action (price ceilings and imports) at levels only about one-half the rice import price, \$0.40/kg in 1974. (See Table 9). Producer prices, though less controllable because of the existence of parallel markets, are depressed by this action. Among effects of this type of price policy are stimulation of rice consumption at the expense of other cereals and foods, reduction of farmer's incomes and production incentives, and a net income transfer from farmers to consumers within the market sector.

Attempts by the government to stimulate production by subsidizing inputs--investment and purchased inputs--cannot counteract lack of effective demand for the farmer's outputs at a price that would enable him to make the investments and annual cash outlays necessary to increased productivity. Government subsidized inputs are in any case usually a two-edged sword tying the farmer into short term repayment and compulsory marketing to the government at fixed prices.

Research is needed into the potential beneficial effects of a demand theory of agricultural development as opposed to the usual supply theory which implicitly assumes that output prices are unimportant as long as inputs are subsidized. Subsidized inputs are usually available to only a small number of a nation's farmers. How might the rest respond to higher producer prices?

Table 4 Total Cereals Production, Rice Production, and Rice as a Percentage of all Cereals Production in WARDA Countries, 1970-1972 Averages ^{a/}

Country	All Cereals	Rice ^{b/}	
	(1, 000 MT)	(1, 000 MT)	(Percent)
Dahomey	268	7	2.6
Gambia	71	41	59.0
Ghana	703	57	8.1
Ivory Coast	492	340	69.1
Liberia	182	182	100.0
Mali	922	153	16.5
Mauritania	75	3	3.6
Niger	869	35	4.0
Nigeria	8, 175	329	4.0
Senegal	586	79	13.5
Sierra Leone	474	449	94.7
Togo	219	15	6.3
Upper Volta	934	34	3.7
	<u>13, 970</u>	<u>1, 724</u>	<u>12.3</u>

a/ Average for the 1970-71 through 1972-73 harvest years.

b/ Rough rice (paddy) basis.

SOURCES: Unpublished data from WARDA; WARDA, Annuaire Statistique du Riz, 1974, Volume 2, September 1974.

Table 5 Total and Per Capita Rice Consumption, and Degree of Self-Sufficiency in Rice Production in WARDA Countries -- 1960-64, 1965-69, and 1974

Country	Total Rice Consumption			Rice Consumption Per Capita			Degree of Self-sufficiency		
	1960-64 Average	1965-69 Average	1974	1960-64 Average	1965-69 Average	1974	1960-64 Average	1965-69 Average	1974
	----- 1,000 MT-----			----- kg -----			-----Percent---		
Dahomey	5.3	7.1	9.9	2.4	2.9	3.3	13.1	9.9	39.1
Gambia	25.2	29.0	41.8	67.1	69.2	82.0	63.1	63.1	43.8
Ghana	64.5	62.1	89.3	9.1	7.8	9.3	29.5	43.3	56.2
Ivory Coast	131.4	213.5	253.3	34.0	47.0	43.7	70.0	73.0	70.0
Liberia	90.2	110.4	130.6	89.0	93.0	87.0	64.4	66.1	73.4
Mali	95.3	85.1	117.6	22.6	17.9	20.7	100.0	95.2	44.5
Mauritania	--	9.4	32.5	--	3.6	25.7	--	4.5	3.6
Niger	6.6	16.8	19.1	2.0	4.4	4.3	80.3	94.0	56.5
Nigeria	88.4	118.8	272.8	1.6	1.9	3.8	98.5	99.1	98.3
Senegal	174.0	224.6	264.0	53.0	61.0	60.7	26.7	26.2	12.6
Sierra Leone	179.4	232.4	311.3	82.7	96.4	108.6	91.6	90.8	84.2
Togo	10.7	14.1	7.6	6.7	7.8	3.5	72.0	31.6	67.1
Upper Volta	13.3	21.6	33.6	4.0	4.3	5.8	86.9	87.0	44.3
TOTAL	889.3	1,144.9	1,583.4	10.3	11.7	13.2	67.3	69.1	62.8

SOURCE: WARDA, Annuaire Statistique du Riz, 1974, Volume 2, September 1974.

Table 6 Rice Production in WARDA Countries, 1960-1973

	Production of Paddy ^{a/}		
	1960-65 Average	1965-70 Average	1970-73 Average
	----- 1,000 MT -----		
Dahomey	1.1	1.6	6.8
Gambia	31.7	34.8	41.9
Ghana	34.0	51.4	57.2
Ivory Coast	202.0	308.0	340.3
Liberia	117.0	148.0	181.7
Mali	176.6	157.4	152.6
Mauritania	0.6	0.9	2.7
Niger	10.9	33.6	35.1
Nigeria	197.0	242.0	329.3
Senegal	89.0	117.0	78.7
Sierra Leone	312.0	406.0	448.7
Togo	16.0	20.0	15.0
Upper Volta	33.0	37.2	34.5
	1,220.9	1,557.9	1,724.1

^{a/} Rough rice (Conversion to a milled rice basis requires multiplication by a factor of 0.6).

SOURCE: WARDA, Annuaire Statistique du Riz, 1974, Volume 2, September, 1974.

Table 7 Rice Imports by WARDA Member Countries, 1960-1974

Year	1, 000 MT	1, 000 \$	\$/MT
1960-64 average	275.8	32, 343	117
1965-69 average	349.5	50, 716	145
1970-74 average	500.7	107, 401	200
1970	410.3	51, 875	126
1971	478.4	51, 385	107
1972	439.0	54, 726	125
1973	582.1	142, 768	245
1974	593.9	235, 167	396

SOURCE: Unpublished . from WARDA.

Table 8 Estimates of Deep Water/Floating Rice Areas in the WARDA Member Countries

Country	Hectares	Percent of total rice area	Hectares	Percent of total rice area ^{a/}
Dahomey	2,000	54	2,000 ^{b/}	54
Gambia	18,000	64	18,000 ^{b/}	64
Ghana	10,000	16	225,000	81
Ivory Coast	27,000	9	27,000 ^{b/}	9
Liberia	--	--	-- ^{b/}	--
Mali	150,000	84	500,000	95
Mauritania	500	42	10,000	93
Niger	11,500	66	15,000	72
Nigeria	90,000	33	250,000	57
Senegal	10,000	13	10,000 ^{b/}	13
Sierra Leone	12,000	4	12,000 ^{b/}	4
Togo	2,500	13	2,500 ^{b/}	13
Upper Volta	3,500	9	3,500 ^{b/}	9
	<u>337,000</u>	<u>23</u>	<u>1,075,000</u>	<u>49</u>

^{a/} These estimates assume that no net changes in the area allocated to other types of rice production will occur.

^{b/} No estimates of potential area was found in the documents available.

SOURCES: WARDA, "WARDA's Integrated Rice Programme," February 1975; IBRD, "Appraisal of the Mopti Rice Project," 1971; WARDA, "Rice in West Africa," March 1974; FAO "Development of Rice Cultivation in West Africa," July 1970; J. G. Vianen, "Some Notes on Deep-flooded and Floating Rice Cultivation in the WARDA Region," N.D. (1975).

Table 9. Rice Prices in WARDA Countries, 1972-73 and 1973-74 (in \$/kg)^{a/}

Country	1972-73			1973-74		
	Producer	Retail	Margin	Producer	Retail	Margin
Ghana	0.05	0.26	0.21	0.09	0.42	0.33
Liberia	0.08	0.18	0.10	0.14	0.29	0.15
Ivory Coast	0.09	0.36	0.27	0.13	0.45	0.32
Togo	0.09	0.20	0.11	0.12	0.29	0.17
Sierra Leone	0.11	0.30	0.19	0.14	0.45	0.31
Upper Volta	0.05	0.16	0.11	0.06	0.18	0.12
Senegal	--	--	--	0.19	0.58	0.39
Nigeria	0.08	0.29	0.21	0.14	0.43	0.29
Guinea	0.04	0.50	0.10	0.32	0.47	0.15
Sierra Leone	0.08	0.16	0.08	0.11	0.23	0.12
Sierra Leone	0.11	0.20	0.09	0.16	0.25	0.09
Togo	0.16 ^{b/}	0.32	0.16	0.11	0.42	0.31
Upper Volta	0.08	0.26	0.18	0.13	0.35	0.22

Although the data source is not clear on this point, apparently the prices are for rough rice (paddy) at the producer level and for milled rice of varying quality at the retail level.

1971-72.

SOURCE: WARDA, Annuaire Statistique du Riz, 1974, Volume 2, September 1974.

Table 10 Annual Costs and Returns for a Normative Deep Water/
Floating Rice Farm Using Traditional and Improved Practices

Item	Traditional Farm	Improved Farm
Gross income	\$454	\$1,270
Total costs		
Amortization	40	139
Seed	40	44
Fertilizer	--	129
	<u>\$ 80</u>	<u>\$ 312</u>
Net returns	\$374	\$ 958
Net returns/household member	\$ 47	\$ 120
Net returns/labor day	\$ 0.97	\$ 2.00
Cash income	\$226	\$1,078
Cash costs		
Maintenance (livestock and equipment)	13	45
Seed	--	44
Fertilizer	--	129
	<u>\$ 13</u>	<u>\$ 218</u>
Net cash income	\$213	\$ 860
Net cash income/household member	\$ 27	\$ 103

Table 11 Structure and Production of a Normative Deep Water/Floating Rice Farm Using Traditional and Improved Practices

Item	Traditional Farm	Improved Farm
Area	4 ha	4 ha
Total household	8	8
Work force (males 15-35)	3	3
Investment		
Pair of oxen	\$184 ^{a/}	\$184
Plow	73	73
Harrow	--	26
Cultivator	--	67
Seed drill	--	575
Hand tools and equipment	10	10
	<u>\$267</u>	<u>\$935</u>
Total labor days (6 hours)	384	480
Fertilizer use (urea/ammonium phosphate)	--	400 kg/400 kg
Seed use	400 kg	400 kg (improved)
Yield	1,235 kg/ha	3,450 kg/ha
Total production ^{b/}	4,940 kg	13,800 kg
Marketable surplus ^{c/}	2,460 kg	11,720 kg

^{a/} \$1 U.S. = 435 Mali francs.

^{b/} Rough rice basis.

^{c/} Assuming seed use of 400 kg on traditional farms and home consumption of 260 kg of rough rice per household member on both types of farms.

IV. Project Implementation

A. ADMINISTRATIVE ARRANGEMENTS

1. Recipient

WARDA is the grantee and has overall management responsibility for the implementation of the Mopti activity. The role of the GOM is also vital. Mopti-North is a national research station. Station operations fall under the supervision of the Institute d'Economie Rural (IER) in the Ministry of Rural Development and must be coordinated with other national rice research and development programs. The existing harmonious relations between WARDA and the Government of Mali have led to a somewhat unusual situation where Mali tends to defer to WARDA in the establishment and operation of the research facilities and operations at Mopti in the knowledge that regional research at Mopti will benefit rice production in Mali. But it is important that the GOM be a direct participant in the station establishment and operations, for there is no doubt that strong national support -- administrative, technical and eventual financial support -- is imperative to success of the Mopti activity.

Regionally, WARDA has an essential role in focusing national attention to regional research and development priorities, in helping to direct national and multinational resources toward those priorities, even to the point of managing the application of new inputs; but WARDA cannot provide from Monrovia the day to day scientific and administrative support needed for rice research at Mopti. Hence, while WARDA will provide considerable management and scientific support for the completion of the Mopti North facilities and the start up of operations, the GOM must be fully engaged in the process.

While WARDA's demonstrated capacity to implement on-going AID supported activities has been adequate, the management of the Mopti activity demands special attention. The size and complexity of the activity will require substantial WARDA management attention. At the same time, observation of the workload pressures on senior members of the WARDA Executive Secretariat indicates that they are already hard-put to meet the heavy demands placed on them. Hence, a stipulation of AID support to this activity is that necessary workload adjustments or personnel adjustments be made within the WARDA ExSec to reflect the high priority of the Mopti Activity and to permit the assignment of a senior WARDA officer as "project manager" for the Mopti activity with the understanding that he allocate sufficient time to Mopti implementation. Up to four months of his time might be required annually for this activity, assuming additional adequate WARDA staff support, over the initial two year start up period.

Similarly, the GOM should assign a counterpart to the WARDA project manager, with mutual responsibilities delineated.

Because of the current work demands on WARDA's Director of Research, WARDA is planning to recruit a senior expatriate scientist to provide closer

scientific direction and coordination to WARDA's regional research activities at Mopti, Richard Toll, Rokupr, and Buoake. Such an appointment might be a key to permitting the necessary ExSec workload adjustments.

A WARDA GOM letter of understanding was signed on January 30, 1976 incorporating the above points and is attached as Annex D.

B. IMPLEMENTATION PLAN

1. Mopti Activity PPT

The implementation schedule for the Mopt activity is presented on Table 12 in the form of a Project Performance Tracking Network (PPT). Narrative description of the Critical Performance Indicators (CPIs) and other indicators is attached to the Table. In some cases, where the reason for the timing of the CPI is not evident, the narrative description includes a brief explanation.

2. Construction Schedule PPT Subnetwork

A PPT subnetwork, Table 13, schedules the construction/installation aspects of the Mopti activity.

C. EVALUATION PLAN

As discussed in the PP, evaluation of research is difficult in the short run because research is by nature often long term and subject to quantitative judgement.

Evaluation measures have been incorporated into the purpose level EOPS conditions specified on Table 1.

In sum, the EOPS conditions call for the development of improved rice lines and related cultural methods by FY 1981; the development of rice lines or methods that display certain targeted characters (e.g., weed, drought, pest resistance) by FY 1979; and the identification through screening of materials with promise by FY 1978.

To verify the superiority of the new rice varieties and methods, it will be necessary to compare them under farm conditions to the currently recommended varieties and practices. Hence, farmer field trials at Mopti-North will be designed to demonstrate the comparative performance of the different rice varieties and methods under varying conditions, including farmer conditions. In the Mopti, Mali area in 1974, recommended varieties were Malobadian, Nang Kieu, Khao Gaew and Mali Sawm. While information exists on the yields of these varieties conditions, baseline data is not useful for evaluation purposes. The yields of rice varieties tested at different times in different locations will not permit comparisons of one to the other. The varieties must be compared in simultaneous field trials to register valid comparative results.

Prior to year three of the Mopti activity, evaluation will relate more to input-output attainment against OVIs in the log frame and CPIs in the PP. By the end of year three of the activity (Feb 1979) after two seasons of rice research, certain promising materials and methods may have been identified through screening. The actual experiments program should reflect the annual research workplans developed by the station director and approved by WARDA's Scientific and Technical Committee.

Over the initial three year funding period of the Mopti activity, evaluation will be performed routinely by USAID/L and WARDA according to the PPT schedule. Numerous scientists and consultants will be financed by the Consultative Group, the WARDA-Mopti activity grant and WARDA during this period, and should be relied upon to formulate a picture of the project's success. By year four, a thorough outside evaluation should be conducted with Mopti activity funds.

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PRIOR ACTIONS

*March 1976 -- PP Amendment Authorization.
Critical date: June 1976

January 1976, Assistant Scientist Training -- Under funding previously authorized, the four African assistant scientists commence the second six months of their program. This portion of the program consists of on the job scientific training in their individual disciplines, following six months of rice production training.

January 1976 -- WARDA-GOM Agreement signed.
WARDA and the Government of Mali (GOM) sign agreement regarding WARDA support to the Mopti program and WARDA-GOM responsibilities in establishing the station and conducting the research program.

*March 1976 -- Mopti Research Workplan. A team of international and West African rice research scientists (from IRRI, IITA, IRAT, WARDA) develop a recommended detailed Mopti-North program of work including objectives and individual experiments programs to achieve these objectives. These recommended workplans will subsequently be reviewed and approved/ revised by the WARDA Scientific and Technical committee and by the GOM. Critical date: August 1976.

*CPI DESCRIPTION

1. April 1976 -- Grant Agreement Signed. AID and WARDA sign Project agreement for the second year of AID support to WARDA under project No. 625-11-130-382, including support to Mopti. Critical date: July 1976

2. April 1976, Recruitment of Station Director -- Liaison Officer and Agriculture Research/Extension. WARDA-AID begin looking for a senior scientist to serve as the station director and a phd level researcher for

the liaison function required.

3. April 1976, Conversion of Deputy Station Director WARDA researcher, Mr. Chodhury (Pakistan), who arrived WARDA in Feb., 1976, converts to project as Deputy Station Director and Acting Station Director after GA signed.

4. Jan. 1977, Commence Housing Site Development -- Before scientists' housing can be constructed, the housing site has to be developed (landfill, leveling, embankment, roadway). To construct the housing in CY1977, the housing site must be completed before the 1976-77 rain season. This will necessitate final engineering planning prior to the grant agreement and very short lag time for engineering planning, design, review; contracting and construction. Critical date: Jan 1977. (Ref: PPT Sub-network: Construction).

5. June 1976, Asst. Scientists Complete Training.

6. June, 1976, Assistant scientists in Mopti -- The four trained assistant scientists should be assigned to Mopti to work organizing the limited experimental work to be conducted in the 1977-78 crop season. Research programs have to be finalized, scientists organized, prepared and supplies ordered. The assistant scientists may combine their work preparation with travel/study.

7. June 1976, Recruit New Assistant Scientists -- Two to four new assistant scientists (depending on academic background) will be recruited to attend up to four years of postgraduate training.

8. June 1976, Field Trials for 1977-78 crop year plan Malian scientists initiate surveys and begin interviews with GOM officials and selected farmers in order to develop experimental workplans and field trial plans for initial project field trials in the Mopti area.

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GPI DESCRIPTION

9. August 1976, Order transportation equipment -- WARDA orders the vehicles needed to support the Mopti scientists.

*10. August 1976, Engineering Plans/Design Complete. -- Station and housing area skematic showing buildings layout and electrical, potable water and sewage distribution systems. Critical date: October 1976.

-- Topographic survey of the Experimental Farm plus an irrigation plan showing the partitioning and leveling of the subpolders, pumping stations and capacity, new canals and drainage.

-- Blueprints for the buildings.

The Genie Rural should complete this work by August 1976 if construction is to begin promptly in the 1977 dry season. Lead time is needed because of the large amount of construction planned for 1977. Also, equipment must be identified early to allow for procurement and installation in Fall 1977. The Genie Rural requires an estimated 14 man months to finalize all engineering planning and to conduct the contracting process. Consequently three or more engineers must be allocated to the planning process, March - August 1976.

*11. September 1976, Inventory of basic lab equipment - To facilitate the arrival of basic laboratory equipment essential for the commencement of Mopti operations in the second half of 1977, IITA will develop a list of basic lab equipment needed for Mopti-North startup, for WARDA and GOM review. Critical date: December 1976.

12. September 1976, Bids for pumps, generators -- Following the completion of engineering planning and specifications for the experimental farm and housing a in August 1976, WARDA will call for quotes on equipmen such as water pumps and the 60 kw and the 30 kw electr generators required for the experimental farm and hous area physical infrastructure, which must arrive and be installed upon the physical completion of the station the fall 1977.

13. September 1976, Asst. Scientists start postgradua training -- Those new assistant scientists requiring E English language training prior to training in their discipline begin English training.

14. July 1977 -- Complete development of housing s -- The housing site foundation development must be completed before rainy season and flood conditions mak work conditions too difficult.

15. November 1976, Bids for station equipment -- Equipment which does not have to be in place as early the vehicles, generators and pumps or which has a shor delivery lag time can be ordered a bit later. Quotes should be requested for furniture, farm equipment, off equipment and the basic laboratory equipment by Novemb 1976.

16. November 1976, Order pumps and generators.

*17. November-December 1976, Station Director arrives To assist with the multitude of administrative and scientific steps needed to commence limited research operations by mid year 1977 and full operations by lat fall 1977, the station director should arrive in West Africa as soon as possible. A realistic schedule for

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CPI DESCRIPTION (Continued)

his arrival might be late 1976. He would be engaged initially in consultation, travel/study (1-2 months) before plunging into operations -- a) reviewing, revising research targets and workplans, b) organizing assistant scientists work, c) preparing for the 1977 crop year experiments (land preparation, supplies), d) insuring the recruitment of essential personnel, e) installation of essential administrative systems (payroll, personnel, accounting supply, maintenance), insuring the completion of station construction. Critical date: June 1977.

*18. January 1977, Begin station and housing construction

-- The construction and installation of the scientists housing, the research station buildings (office, labs, green house, screen house) and the development of the experimental plots (partition, leveling, interior canals, pumping stations) should begin as soon as the remission of the flood allows. To commence construction in January will require the timely prior completion of engineering planning and contracting. (See item 11).
Critical: March 1977.

*19. January 1977, Order station equipment -- Quotes should have been appraised so that equipment needed in the Fall 1977 season can be ordered. Critical: Jan 1977.

20. February 1977, Inventory/Order Supplies -- One of the essential steps in preparing for experimental work in crop year 1977-78 is to order or arrange for the necessary seed, fertilizer, paper, books, journals and other supplies needed for the work planned. These orders must be based on preliminary plans.

21. April 1977, Research workplans -- The individual detailed workplans for each of the scientists should be finalized by Spring 1977 after each of the scientists

have been on-board for several months. These plans will serve as the basis for organizing and conducting the first year's research program.

22. July 1977, Complete Experimental Farm Improvement -- The leveling, partition and development of the experimental plots irrigation system is a relatively simple portion of the construction and is planned completion early enough in 1977 to allow land preparation and the sowing of trials and experiments; beginning with the 1977 rainy season. The irrigation pumps ordered November 1976 should have arrived and been installed at the beginning of the rainy season. Critical: July 1977.

23. May 1977, Consultants' schedule -- Following finalization of research workplans, the station director will decide what kind of consultant help will be needed in the upcoming year. With WARDA's assistance, steps will be taken to arrange the consultancies needed.

24. May 1977, Order remaining lab equipment -- Following the arrival of all scientists, the laboratory and field equipment previously ordered for the station by WARDA/GOM, should be reviewed and additional laboratory equipment ordered with the funds still remaining for this purpose.

25. August 1977, Staff on-board -- Non professional station staff should be recruited in time to provide training needed for the full start-up of station operations in November 1977.

26. August - September 1977, Field experiments -- Experiments should be in place in the experimental plots to correspond to the 1977-78 crop season. This target presupposes arrangements for labor, land preparation

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CPI DESCRIPTION (Continued)

sowing. These experiments will be comprised mainly of screening which are to provide initial identification of promising materials. Critical: September 1977.

27* September 1977, Complete construction of housing and station -- The completion of the construction of the scientists housing, station buildings, is scheduled nine months after commencement of construction. Critical: 1/78.

28. November 1977, Administrative systems operational -- Two months are allowed following the physical completion of the station to shakedown all administrative systems.

29. November 1977, Full operations -- With all physical administrative and research programs and facilities in place, the station is considered to be in full operation.

30. December 1977, Evaluation -- By the end of month 22, a routine AID-WARDA-GOM evaluation should be conducted to assure that all inputs and outputs scheduled have been achieved.

31. January 1978, New Assistant Scientists complete training -- At least two new assistant scientists will complete postgraduate training and be assigned to the Mopti program.

32. March 1978, Analysis of experiments -- Most experimental results (the 1977-78 crop season) will have been recorded. The results will be documented and appraised as the foundation for the second year research program. Results will also be reviewed by the GOM, and WARDA's Scientific and Technical Committee.

33. April 1978, Experimental workplans for year two -- Based on year one results, individual workplans will be developed for the 1978-79 crop year as a basis for organizing and conducting the experimental work.

*34. May 1977, Field Trials Plans -- With the arrival of the assistant scientist responsible for farmers field trials, plans will be drawn up for the implementation of farmers field trials including plans for selecting production packages; developing technical instructions, methodologies, and training; determining the size and scope of the trials, the amount of station resources necessary; the liaison with other agencies, and organizing their support. Critical: May 1977.

35. September 1978, Farmer Field Trials -- Farmer field trials should be underway in accordance with the field trials program developed in April 1978. At a minimum the Mopti station should have arranged for farmer field trials with "Operation Riz Mopti (ORM)" and with Birn Kebbi in Nigeria, in the two most important deep water floating rice areas in the WARDA region.

36. March 1979, Analysis of year two experiments -- This is a repeat of PPT indicator No. 34, conducted one year later.

37. March 1979, Evaluation -- The routine evaluation which would normally occur in December 1978 should be delayed several months till March 1979 in order to benefit from the Feb-March analysis and report by the Mopti station of the research results of the 1978-79 season.

38. April 1979, Experimental Workplans for year three -- This is a repeat of the previous years exercise build on new information and experience (PPT indicator No. 33).

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CPI DESCRIPTION (continued)

39. September 1979, Farmers Field Trials - This is a repeat of the previously years exercise (PPT No. 35), building on new information and experience.

40. March 1980, New lines/methods developed -- At the purpose level, achievement of improved lines/method may be expected, at the earliest, in the Spring of 1980 following the third season of deep water/floating rice cultivation and experiments (Reference Table 1, Purpose - level EOPS).

41. March 1980, Evaluation - Purpose level evaluation can be conducted following appraisal of experimental results of the 1979-80 season.

*27a - September, 1977 -- Based on tentative planning agreed to by WARDA, initial farmers field trials will begin during the 1977-78 crop season on selected farmer's fields in accordance with workplans developed in April, 1976 (see item 21).

73.

73

Attachment to Table 13. Narrative Description of PPT Subnetwork

a. January 1976 -- (item 4 on master PPT) WARDA-GOM Agreement signed.

b. February 1976 -- Begin Engineering Planning for Housing site, Housing and station.

The Rural Engineering Division of the GOM Ministry of Rural Development proceeds with final engineering plans and development of specifications for the development of 1) the scientists housing site (adjacent to the Mopti-North station, 2) the scientists housing, 3) the Mopti-North station buildings. Critical Date - 4/76.

c. March 1976 -- Begin Topographic Survey of Experimental Farm.

This survey, also being done by the GOM Rural Engineering Division is needed to improve the experimental farms hydraulic system (see g. below). Critical date - 5/76.

75. d. April 1976 -- (item 3. on PPT) -- Grant Agreement.

e. April 1976 -- Complete Topographic Survey.

Critical date - 7/76.

f. May 1976 -- Complete Rice Research Workplan.

The detailed research workplan permits the final engineering decisions about the number, size, location, hydraulic characteristics of the experimental farm improvement (see g. below). Critical date 7/76.

g. May 1976 -- Begin Engineering Plans for Experimental Farm and hydraulic improvement.

Develop plans for final land leveling, interior plot design and diking, interior irrigation and drainage ditches, and water pump installation. Critical - 7/76.

Attachment to Table 13. Narrative Description of PPT Subnetwork (continued)

- h. July 1976 -- Complete Engineering Plans for Farm and hydraulic Improvement. Critical 9/76.
- i. August 1976 -- Complete Engr. Plans for Housing site, housing & station buildings. Critical 9/76.
- j. August 1976 -- AID Approval of Engr. Plans for Farm/Hydraulic Improvement.
- k. September 1976 -- AID Approval of Engr. Plans for Housing & Station Buildings.
- l. September 1976 (Item 13 on PPT) -- Quotes for Pumps, generators.
- m. September 1976 -- AID Review of Bid Evaluation.
For houses, station buildings and systems and experimental farm and hydraulic improvement.
76. n. October 1976 -- Sign Contracts. For housing site, houses, station buildings and systems and experimental farm and hydraulic improvement. Critical 11/76.
- o. November 1976 (Item 17 on PPT) -- Order Pumps, Electrical Generators.
- p. January 1977 (Item 19 on PPT) -- Begin Construction of houses, station buildings and systems, and experimental farm and hydraulic improvement. Critical 1/77.
- q. June 1977 (Item 25 on PPT) -- Complete Farm & Hydraulic Improvement. Critical 7/77.
- r. July 1977 -- Complete construction of housing, station buildings.
- s. September 1977 -- Installation/Equipment/systems hookup.
A period of one-two months is allowed following the construction of the basic physical infrastructure for the installation and shakedown of equipment and systems (laboratory, electrical, potable water, sewage, etc.)
- t. September 1977 (PPT item 32) -- Station commences full operation.
- u. November 1977 -- AID Review of Construction

ANNEX A

**PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK**

Project Title & Number: Rice Research & Production 698-11-190-382

PAGE 1

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
<p>Program or Section Goal:</p> <p>To increase the quality and quantity of rice production in WARDA member countries in order to approach regional self sufficiency.</p>	<p>WARDA member countries increase rice production from the current level to approach regional consumption.</p>	<p>WARDA and member country records on rice production, consumption and trade.</p>	<ol style="list-style-type: none"> 1. WARDA will continue to be a viable institution strongly supported by its members and by multilateral donors. 2. Modern agricultural technology can be developed which will be accepted by farmers in member states. 3. West Africa has a comparative advantage in production of rice. 4. Member countries will pursue rice price policies that offer incentives to rice farmers. 5. Weather is not abnormally severe.
<p>Asterisk denotes revision in original Log Frame</p>			

77.

ANNEX A

**PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK**

Project Title & Number: _____

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
<p>Project Purpose:</p> <p>1. To develop new high yielding rice varieties and cultural practices for specified rice types of regional priority.</p> <p>2. To disseminate high yielding varieties and related cultural practices to West African Farmers.</p>	<p>Conditions that will indicate purpose has been achieved: End-of-Project status.</p> <p>*1.a. FY 1981 (Rokupr) FY 1982 (Mopti) New lines and methods yield higher than currently recommend varieties and methods under farm conditions.</p> <p>1.b. FY 1979 (Rokupr) FY 1980 (Mopti) Rice lines and methods developed displaying certain targeted characters, e.g., higher yield, better disease, pest, or weed resistance, elongation.</p> <p>*1.c. FY 1979 Screening results in identification of material and methods with promise for research targets achievement.</p> <p>1.d. FY 1977 Research workplans and experiments adhere to regional priorities.</p> <p>2.a. FY 1979 Varieties and practices developed are being field tested and demonstrated via national programs.</p>	<p>*1.a. Field trials records-- comparison of yields based on field trials.</p> <p>*1.b. Records of experimental results -- Targeted characters have been demonstrated under experimental conditions.</p> <p>*1.c. Records of experimental results--Experiments have indicated high potential breeding materials and methods for further study.</p> <p>*1.d. Research workplans approved by WARDA.</p> <p>2.a. Assessment based on research station and extension agency reports as to whether recommended varieties are being field tested and extended.</p> <p>1) FY 77 and 79 - Initial and final trainee rice skill test scores of WARDA-trained rice production specialists.</p>	<p>1. Coordinated rice research, where research stations concentrate efforts on rice types of regional priority and share research results with other stations is more efficient than research where national stations pursue only national objectives in relative isolation.</p> <p>2.a. Member countries support rice extension programs in support of traditional small farmers.</p> <p>2.b. Trained rice production staff (outputs) are assigned to plan and implement rice extension training courses and extension programs.</p> <p>2.c. That other inputs needed for adoption of modern technology -- credit, organization, fertilizer, etc. are provided.</p> <p>2.d. Effective linkages are established by WARDA and national agencies between research and extension agencies.</p>

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ANNEX A

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Project Title & Number: _____

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
<p>Project Purpose:</p>	<p>Conditions that will indicate purpose has been achieved: End-of-Project status.</p> <p>2.b. FY 1979 WARDA trained personnel operating at higher capability and productivity.</p>	<p>2) Number of rice specialists trained by WARDA trained rice production specialists.</p> <p>3) Capability of extension agents trained by WARDA - trained rice production specialists (as indicated by rice skills test scores).</p> <p>4) Productivity of extension agents trained by WARDA - trained rice production specialists as indicated by (a) the number of farmers reached (b) the crop yields of farmers reached (perhaps in farmer demonstrator fields or designed experimental farmer field trails areas).</p>	

ANNEX A

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Project Title & Number: _____

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NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
<p>Project Outputs:</p> <ol style="list-style-type: none"> 1. Integrated rice research experiments in (a) breeding (b) pathology (c) entomology (d) weed control (e) fertilization (f) cultural practices, etc. which address the major constraints to increase yields and production of the priority rice types, i.e., floating and deep water rice, mangrove swamp rice and irrigated rice for Sahel river basin development. 2. Trained African scientists. 3. Trained rice production and research staff. 4. Established training center. *5. Establishment of research facilities at Rokupr (mangrove swamp rice research) and at Mopti (deep water and floating rice research). *6. Mopti station program to field test and extend research results. 	<p>Magnitude of Outputs:</p> <ol style="list-style-type: none"> 1. Rice research plans will be developed for each research station identifying the primary constraints to be addressed and describing and scheduling (to the extent reasonable) each scientist's activities. 2.a. Assistant scientist work as understudies for WARDA financed senior scientists. 2.b. African assistant scientists complete post-graduate training: 8 in FY 1976, 3 in FY 1978. 3. Ninety rice production staff trained annually at Johnsonville. 4. Dormitory constructed, training plots built, translation and other equipment installed. *5. Housing, offices, laboratories and experimental plots constructed, equipped; administrative systems in place and station in operation. (TABLE 13 schedules Mopti Station construction/installation schedule) 	<ol style="list-style-type: none"> 1. Assessment of research activities against station research workplans. <p>Outside Research</p> <ol style="list-style-type: none"> 2. WARDA records. 3. Training Center records. 4. Training center in full operation. 5. Rokupr Mopti WARDA research underway. *6. Mopti station records and reports. 	<ol style="list-style-type: none"> 1. Station research workplans are designed to integrate research efforts whereby WARDA and national scientists comprises a single team, under unilateral scientific leadership, addressing research objectives jointly set out in the workplan. This assume also that WARDA activities, i.e., W1, W2, W3, and W4 are integrated at the station level as mutually reinforcing activities/projects. 2. WARDA staff as supplemented by AID's training inputs is adequate to design and conduct a training curriculum and program for rice production staff. 3. Personnel trained under this project, especially the African research scientists, serve after training in research work as intended. 4. Other donors and national governments provide station inputs as planned. *5. WARDA routinely introduces Mopti-developed materials, methods into regional trials.

**PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK**

Project Title & Number: _____

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NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
<p>Project Outputs:</p>	<p>Magnitude of Outputs:</p> <p>*6.a. Field trials planned and underway.</p> <p>6.b. Technical instructions developed re recommended production packages".</p> <p>6.c. Training courses and materials developed for field trials officers.</p>		<p>*6. Operation Riz Mopti and other selected national agencies support preliminary field trials of Mopti materials.</p>

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORKProject Title & Number: WARDA

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
<p>Project Inputs:</p> <p>1. Research inputs are: (a) personnel-- plant breeders, pathologists, entomologists, weed specialists, short-term consultants, administrative staff (b) construction and commodities -- office, laboratory equipment, green and screen houses, land development, seed processing and storage facilities, vehicles, etc. (c) training -- postgraduate and under-study training for African scientists.</p> <p>2. Training inputs are: (a) personnel-- training director, farm manager, admin staff, (b) construction and commodities-- 40 man dormitory (including construction design), training and translation equipment, vehicles.</p>	<p>Implementation Target (Type and Quantity)</p> <p>1. Annex schedules inputs and costs for the research and development programs.</p> <p>2. A more detailed input-output implementation plan will be developed immediately following PP approval to schedule activities and targets.</p>	<p>1. WARDA/national government implementation plans.</p> <p>2. WARDA/USAID budget agreements and grant agreements.</p> <p>3. End of project evaluation by AID consultants.</p>	<p>1. Technical experts are available and can be recruited on schedule at the funding levels indicated to serve at the selected research sites.</p> <p>2. Equipment and supplies can be procured on schedule.</p> <p>3. WARDA members can allocate personnel to these positions to be trained.</p>
<p>NOTE: The original logical framework statement of inputs has not been revised to reflect changes introduced by the addition of the Mopti activity. A more detailed explanation of Mopti activity inputs is presented in Project Description and in Annex B.</p>			

ANNEX B. TABLE 1

PROJECT COSTS -- WARDA - MOPTI ACTIVITY

	<u>5 YEAR TOTAL</u> TOTAL	<u>FY 76</u> TOTAL	<u>FY 77</u> TOTAL	<u>FY 78</u> TOTAL	<u>FY 79</u> TOTAL	<u>FY 80</u> TOTAL
I. INVESTMENT COSTS						
A. CONSTRUCTION						
1. Housing	<u>566.8</u>	<u>245.0</u>	<u>321.8</u>			
a. 6 staff houses, 230 m ² ea @ \$53,360 ea	320.2		320.2			
b. Housing site development - foundation/ embanking (15,000m ²). Fencing (1600 m. incl. entrance gate); water and electrical systems	245.0 ^{1/}	245.0				
c. Guard house	1.6		1.6			
2. Experiment Station buildings	<u>127.2</u>		<u>127.2*</u>			
a. 1 Administrative (130 m ²) office	30.2		30.2			
b. 3 laboratories (incl. 2 offices ea.)	66.3		66.3			
c. 1 threshing floor	7.0		7.0			
d. green house (for breeding work)	15.6		15.6			
e. screen house (for entomology)	8.1		8.1			
3. Hydraulic infrastructure at experimental station	<u>59.0^{2/}</u>	<u>59.0</u>				
4. Engineering planning/design; Construc- tion supervision (24 mm)	<u>27.0</u>	<u>27.0</u>				
CONSTRUCTION SUBTOTAL	<u>780.0</u>	<u>331.0</u>	<u>449.0</u>			

^{1/} Morgan's \$214.5 thousand figure (Bamako 04226) rounded up for 6 house site instead of 4 house site.

^{2/} WARDA's \$90,000 figure minus \$30,200 for 8 450 gal/minute pumps at 3,780 ea. C.I.F.

* - Saudi Arabia funds.

	<u>3 YEAR TOTAL</u> TOTAL	<u>FY 76</u> TOTAL	<u>FY 77</u> TOTAL	<u>FY 78</u> TOTAL	<u>FY 79</u> TOTAL	<u>FY 80</u> TOTAL
B. EQUIPMENT						
1. <u>Electrical generators</u> 1 60 kw and 1 30 kw	25.0 ^{3/}	25.0				
2. <u>Water pumps for station irrigation system</u> 8 units 450 gal./min. ea. (1 unit = \$3,500 CIF)	30.0 ^{4/}	30.0				
3. <u>Agricultural Equipment</u>	32.0	32.0				
a.1 tractor	9.0	9.0				
b.1 leveling blade	1.2	1.2				
c.1 hydraulic backhoe	4.0	4.0				
d.1 disc plow	2.0	2.0				
e.1 mould board plow	2.0	2.0				
f.1 disk harrow	1.5	1.5				
g.2-3 threshing machines (incl. single panicle thresher & small laboratory thresher)	6.2	6.2				
h.1 seed drill	1.6	1.6				
i. sprayers - other small equipment	1.0	1.0				
j. trailer	2.5	2.5				
k. tools	1.0	1.0				
4. <u>Transportation equipment + spare parts</u>	35.0	7.0	28.0*			
a.2 sedans @ 3,500	14.0	7.0	7.0			
b.1 pickup truck	7.0		7.0			
c.1 boat + outboard	4.0		4.0			
d.1 truck (4 tons)	10.0		10.0			

^{3/} \$11,500 F.O.B. for 60 kw generator plus 7,000 F.O.B. for 30 kw generator + 35% insurance, freight.

^{4/} \$2,800 each for 8 450 gal/min pumps + 35% insurance, freight.

*- Saudi Arabia Funds

	<u>5 YEAR TOTAL</u>	<u>FY 76</u>	<u>FY 77</u>	<u>FY 78</u>	<u>FY 79</u>	<u>FY 80</u>
	<u>TOTAL</u>	<u>TOTAL</u>	<u>TOTAL</u>	<u>TOTAL</u>	<u>TOTAL</u>	<u>TOTAL</u>
B. Equipment (cont'd.)						
<u>5. Office Equipment</u> ^{5/}	<u>22.4</u>		<u>21.8*</u>	<u>0.6</u>		
a.2 expert desks	1.6		1.6			
b.5 assistant desks	3.0		2.4	0.6		
c.other desks, cupboards filing cabinets	4.0		4.0			
d.2 calculators	1.4		1.4			
e.4 typewriters	1.2		1.2			
f.1 photocopy machine	1.2		1.2			
g.20 air-conditioners	10.0		10.0			
<u>6. Laboratory equipment</u>	<u>70.0</u>	<u>12.0</u>	<u>23.0*</u>	<u>35.0</u>		
<u>EQUIPMENT SUBTOTAL</u>	<u>214.4</u>	<u>106.0</u>	<u>72.8*</u>	<u>35.6</u>		
<u>SUBTOTAL (A + B)</u>	<u>994.4</u>	<u>437.0</u>	<u>521.8</u>	<u>35.6</u>		
<u>INVESTMENT TOTAL</u>	<u>994.4</u>	<u>437.0</u>	<u>521.8</u>	<u>35.6</u>		
II. OPERATIONAL COSTS						
<u>A. DIRECT COSTS</u>						
<u>1. Personnel</u> ^{6/}	<u>448.2</u>	<u>93.0</u>	<u>176.2</u>	<u>179.2</u>	<u>186.0</u>	<u>186.0</u>
a.Station Director @ 55,000		27.5	55.0	55.0	55.0	55.0
b.Deputy station director @ 35,000		25.0	35.0	35.0	35.0	35.0
c.Assistant experts four @ 6,000		12.0	24.0	24.0	30.0	30.0
d.Farm manager @ 6,000		2.0	3.0	6.0	6.0	6.0
e.Research/Extension Off		10.0	30.0	30.0	30.0	30.0
f.Admin/Finance Off		3.0	4.0	4.0	4.0	4.0
g.4 field assistants		1.2	2.4	2.4	2.4	2.4
h.bookkeeper		0.8	1.4	1.4	1.4	1.4
i.4 clerk/typists		1.0	3.0	3.0	4.0	4.0
j.4 lab. assistants		2.7	3.0	3.0	3.0	3.0

^{5/} Minor upward adjustments a WARDA's figures

^{6/} In FY 1977, personnel cost are funded for 6 months, i.e., Jan. - June 1977.

* - Saudi Arabia Funds

	<u>5 YEAR TOTAL</u>	<u>FY 76</u>	<u>FY 77</u>	<u>FY 78</u>	<u>FY 79</u>	<u>FY 80</u>
	<u>TOTAL</u>	<u>TOTAL</u>	<u>TOTAL</u>	<u>TOTAL</u>	<u>TOTAL</u>	<u>TOTAL</u>
1. Personnel (Cont'd)						
k. 3 artisans		0.5	2.4	0.8	0.8	0.8
l. store keeper		1.3	1.0*	2.5	2.5	2.5
m. 3 drivers		0.9	1.8	1.8	1.8	1.8
n. tractor driver		0.3	0.6*	0.6	0.6	0.6
o. 2 messengers		0.5	1.0*	1.0	1.0	1.0
p. 3 maids		0.8	1.6*	1.5	1.5	1.5
q. 2 watchmen		0.5	1.0*	1.0	1.0	1.0
r. laborers (5000 man-days)		3.0	6.0*	6.0	6.0	6.0
2. Housing rental (60 months + 6 scientists x 10 months each)	<u>54.0</u>	<u>18.0</u>	<u>18.0*</u>	<u>18.0</u>		
3. Travel and/or Study	<u>35.0</u>	<u>7.0</u>	<u>7.0*</u>	<u>7.0</u>	<u>7.0</u>	<u>7.0</u>
4. Misc. Technical Assistance	<u>76.0</u>		<u>10.0*</u>	<u>22.0</u>	<u>22.0</u>	<u>22.0</u>
a. Visiting consultants (80 man days = 40 man days/yr. = 10 days/discipline/yr)			5.0	10.0	10.0	10.0
b. Institutional services			5.0	12.0	12.0	12.0
5. Office Supplies	<u>48.7</u>		<u>8.5*</u>	<u>13.4</u>	<u>13.4</u>	<u>13.4</u>
a. Reference materials, journals			2.0	0.5	0.5	0.5
b. stationary			1.0	2.0	2.0	2.0
c. photocopy paper			0.2	0.4	0.4	0.4
d. public utilities			5.0	10.0	10.0	10.0
e. postal			0.3	0.5	0.5	0.5
6. Laboratory costs	<u>44.0</u>		<u>11.0*</u>	<u>11.0</u>	<u>11.0</u>	<u>11.0</u>
a. supplies entomology			3.0	3.0	1.0	1.0
b. supplies plant breeding			2.5	2.5	2.5	2.5
c. supplies weed research			2.5	2.5	2.5	2.5
d. miscellaneous -- pots, plastic bags, netting etc.			3.0	3.0	3.0	3.0

*Saudi Arabia Funds

	<u>F YEAR TOTAL</u>	<u>FY 76</u>	<u>FY 77</u>	<u>FY 78</u>	<u>FY 79</u>	<u>FY 80</u>
	<u>TOTAL</u>	<u>TOTAL</u>	<u>TOTAL</u>	<u>TOTAL</u>	<u>TOTAL</u>	<u>TOTAL</u>
<u>Experimental Farm</u>	<u>164.0</u>		<u>29.0*</u>	<u>45.0</u>	<u>45.0</u>	<u>45.0</u>
a. Fertilizer & chemicals 50 hr @ \$200			10.0	10.0	10.0	10.0
b. Tractor 1000 hrs @ 3. hr.			3.0	3.0	3.0	3.0
c. Car & pickup @ 1,500 ea			3.0	3.0	3.0	3.0
d. Truck			3.0	3.0	3.0	3.0
e. Pumping cost			2.0	2.0	2.0	2.0
f. Maintenance/spare parts for agri equip			1.0	2.0	2.0	2.0
g. Tools, bags, etc. 50 hr @ 50.00			2.5	2.5	2.5	2.5
h. Boat maintenance			0.5	0.5	0.5	0.5
i. Maintenance of housing, roads			2.0	10.0	10.0	10.0
j. Operation/maintenance generators			2.0	10.0	10.0	10.0
87. <u>SUBTOTAL, DIRECT COSTS</u>	<u>1,242.1</u>	<u>118.0</u>	<u>259.7</u>	<u>295.6</u>	<u>284.4</u>	<u>284.4</u>
<u>OPERATIONS TOTAL</u>	<u>1,242.1</u>	<u>118.0</u>	<u>259.7</u>	<u>295.6</u>	<u>284.4</u>	<u>284.4</u>
I. <u>PARTICIPANT TRAINING</u>	<u>254.0</u>		<u>64.0</u>	<u>50.0</u>	<u>70.0</u>	<u>70.0</u>
1. 12 mos. English training			16.0	16.0	16.0	16.0
2. 48 months post graduate study			48.0	34.0 ^{7/}	34.0	34.0
3. Ph.D. Training					20.0	20.0
<u>SUBTOTAL, PARTICIPANT TRNG</u>	<u>254.0</u>		<u>64.0</u>	<u>50.0</u>	<u>70.0</u>	<u>70.0</u>
• <u>CONTINGENCY (5% SIMPLE)</u>	<u>59.4</u>			<u>33.8</u>	<u>12.8</u>	<u>12.8</u>
<u>INFLATION (10% compounded annually)</u>	<u>211.1</u>				<u>89.1</u>	<u>122.0</u>
<u>SUBTOTAL, 1st THREE YEARS</u>	<u>1,815.5</u>	<u>555.0</u>	<u>845.5^{8/}</u>	<u>415.0</u>		
<u>GRAND TOTAL</u>	<u>2,761.0</u>	<u>555.0</u>	<u>845.5</u>	<u>415.0</u>	<u>456.3</u>	<u>489.2</u>

7/ 34 months post graduate training.

8/ \$100,000 of Saudi Arabia funds available in FY 76, however prefer to use Saudi funds to supplement U.S. funds where possible. Expect that entire \$300,000 will be expended in CY 77 when funding requirements are clearer.

* Saudi Arabia funds.

ANNEX B. TABLE 2.

LOCAL COSTS -- WARDA - MOPTI ACTIVITY

	<u>5 YEAR-TOTAL</u>	<u>FY 76</u>	<u>FY 77</u>	<u>FY 78</u>	<u>FY 79</u>	<u>FY 80</u>
I. INVESTMENT COSTS						
A. CONSTRUCTION						
1. Housing						
a. 6 staff houses, 230 m ² ea@53,360 ea	<u>368.9</u>	<u>159.3</u>	<u>209.7</u>			
b. Housing site development - foundation/ embanking (15,000m ²).	<u>208.1</u>		<u>208.1</u>			
c. Fencing (1600 m. incl. entrance gate): Water and electrical systems	<u>159.3</u> ^{1/}	<u>159.3</u>				
c. Guard house	1.6		1.6			
2. <u>Experiment Station Buildings</u>	<u>85.1</u>		<u>85.1</u> *			
a. 1 Administrative (130 m ²) office	19.6		19.6			
b. 3 Laboratories (incl. 2 offices ea.)	43.1		43.1			
c. 1 threshing floor	7.0		7.0			
d. green house (for breeding work)	10.1		10.1			
e. screen house (for entomology)	5.3		5.3			
3. <u>Hydraulic infrastructure at experimental station</u>	<u>59.0</u> ^{2/}	<u>59.0</u>				
4. <u>Engineering planning/design; Construc- tion supervision (24 mm)</u>	<u>27.0</u>	<u>27.0</u>				
<u>CONSTRUCTION SUBTOTAL (LC)</u>	<u>540.1</u>	<u>245.3</u>	<u>294.7</u>			

^{1/} Morgan's \$214.5 thousand figure (Bamako 04226) rounded up for 6 house site instead of 4 house site.

^{2/} WARDA's \$90,000 figure minus \$30,200 for 8 450 gal/minute pumps at 3,780 ea. C.I.F.

* - Saudi Arabia funds.

	<u>3 YEAR TOTAL</u>	<u>FY 76</u>	<u>FY 77</u>	<u>FY 78</u>	<u>FY 79</u>	<u>FY 80</u>
B. EQUIPMENT						
1. <u>Electrical generators</u>	-	-				
1 60 kw and 1 30 kw	-	-				
2. <u>Water pumps for station irrigation system</u>						
8 units 450 gal./min. ea. (1 unit = \$3,500 CIF)	-	-				
3. <u>Agricultural Equipment</u>	-	-				
a.1 tractor						
b.1 leveling blade						
c.1 hydraulic backhoe						
d.1 disc plow						
e.1 mould board plow						
f.1 disk harrow						
g.2-3 threshing machines (incl. single panicle tresher & small laboratory thresher)						
h.1 seed drill						
i. sprayers - other small equipment						
j. trailer						
k. tools						
4. <u>Transportation equipment + spare parts</u>	-	-	-			
a.2 sedans @ 3,500						
b.1 pickup truck						
c.1 boat + outboard						
d.1 truck (4 tons)						

3/\$11,500 F.O.B. for 60 kw generator plus 7,000 F.O.B. for 30 kw generator + 35% insurance, freight.

4/ \$2,800 each for 8 450 gal/min pumps + 35% insurance, freight.

*- Saudi Arabia Funds

	<u>5 YEAR TOTAL</u>	<u>FY 76</u>	<u>FY 77</u>	<u>FY 78</u>	<u>FY 79</u>	<u>FY 80</u>
B. Equipment (cont'd.)						
<u>5. Office Equipment</u> ^{5/}	-	-	-	-	-	-
a.2 expert desks						
b.5 assistant desks						
c.other desks, cupboards filing cabinets						
d.2 calculators						
e.4 typewriters						
f.1 photocopy machine						
g.20 air-conditioners						
<u>6. Laboratory equipment</u>	-	-	-	-	-	-
<u>EQUIPMENT SUBTOTAL</u>	-	-	-	-	-	-
<u>SUBTOTAL (A + B)</u>	-	-	-	-	-	-
<u>INVESTMENT TOTAL</u>	<u>540.1</u>	<u>245.3</u>	<u>291.7</u>	-	-	-
II. OPERATIONAL COSTS						
<u>A. DIRECT COSTS</u>						
<u>1. Personnel</u> ^{6/}	<u>407.9</u>	<u>410.5</u>	<u>86.2</u>	<u>82.2</u>	<u>96.0</u>	<u>96.0</u>
a.Station Director @ 55,000		-	-	-	-	-
b.Deputy station director @ 35,000		-	-	-	-	-
c.Assistant experts four @ 6,000		12.0	24.0	24.0	30.0	30.0
d.Farm manager @ 6,000		2.0	3.0	6.0	6.0	6.0
e.Research/Extension Off		10.0	30.0	30.0	30.0	30.0
f.Admin/Finance Off		3.0	4.0	4.0	4.0	4.0
g.4 field assistants		1.2	2.4	2.4	2.4	2.4
h.bookkeeper		0.8	1.4	1.4	1.4	1.4
i.4 clerk/typists		1.0	3.0	3.0	4.0	4.0
j.4 lab. assistants		2.7	3.0	3.0	3.0	3.0

^{5/} Minor upward adjustments WARDAs figures

^{6/} In FY 1977, personnel cost are funded for 6 months, i.e., Jan. - June 1977.

* - Saudi Arabia Funds

	<u>3 YEAR TOTAL</u>	<u>FY 76</u>	<u>FY 77</u>	<u>FY 78</u>	<u>FY 79</u>	<u>FY 80</u>
1. Personnel (Cont'd)						
k. 3 artisans		0.5	2.4	0.8	0.8	0.8
l. store keeper		1.3	1.0*	2.5	2.5	2.5
m. 3 drivers		0.9	1.8	1.8	1.8	1.8
n. tractor driver		0.3	0.6*	0.6	0.6	0.6
o. 2 messengers		0.5	1.0*	1.0	1.0	1.0
p. 3 maids		0.8	1.6*	1.5	1.5	1.5
q. 2 watchmen		0.5	1.0*	1.0	1.0	1.0
r. laborers (5000 man-days)		3.0	6.0*	6.0	6.0	6.0
2. Housing rental (60 months + 6 scientists x 10 months each)	<u>54.0</u>	<u>18.0</u>	<u>18.0*</u>	<u>18.0</u>		
3. Travel and/or Study	<u>35.0</u>	<u>7.0</u>	<u>7.0*</u>	<u>7.0</u>	<u>7.0</u>	<u>7.0</u>
4. Misc. Technical Assistance	-	-	-	-	-	-
a. Visiting consultants (80 man days = 40 man days/yr. = 10 days/discipline/yr)						
b. Institutional services						
5. Office Supplies	<u>48.7</u>		<u>8.5*</u>	<u>13.4</u>	<u>13.4</u>	<u>13.4</u>
a. Reference materials, journals			<u>2.0</u>	<u>0.5</u>	<u>0.5</u>	<u>0.5</u>
b. stationary			<u>1.0</u>	<u>2.0</u>	<u>2.0</u>	<u>2.0</u>
c. photocopy paper			<u>0.2</u>	<u>0.4</u>	<u>0.4</u>	<u>0.4</u>
d. public utilities			<u>5.0</u>	<u>10.0</u>	<u>10.0</u>	<u>10.0</u>
e. postal			<u>0.3</u>	<u>0.5</u>	<u>0.5</u>	<u>0.5</u>
6. Laboratory costs	<u>44.0</u>		<u>11.0*</u>	<u>11.0</u>	<u>11.0</u>	<u>11.0</u>
a. supplies entomology			<u>3.0</u>	<u>3.0</u>	<u>1.0</u>	<u>1.0</u>
b. supplies plant breeding			<u>2.5</u>	<u>2.5</u>	<u>2.5</u>	<u>2.5</u>
c. supplies weed research			<u>2.5</u>	<u>2.5</u>	<u>2.5</u>	<u>2.5</u>
d. miscellaneous -- pots, plastic bags, netting etc.			<u>3.0</u>	<u>3.0</u>	<u>3.0</u>	<u>3.0</u>
*Saudi Arabia Funds						

	<u>5 YEAR TOTAL</u>	<u>FY 76</u>	<u>FY 77</u>	<u>FY 78</u>	<u>FY 79</u>	<u>FY 80</u>
<u>Experimental Farm</u>	<u>164.0</u>		<u>29.0*</u>	<u>45.0</u>	<u>45.0</u>	<u>45.0</u>
a. Fertilizer & chemicals 50 hr @ \$200			10.0	10.0	10.0	10.0
b. Tractor 1000 hrs @ 3. hr.			3.0	3.0	3.0	3.0
c. Car & pickup @ 1,500 ea			3.0	3.0	3.0	3.0
d. Truck			3.0	3.0	3.0	3.0
e. Pumping cost			2.0	2.0	2.0	2.0
f. Maintenance/spare parts for agri equip			1.0	2.0	2.0	2.0
g. Tools, bags, etc. 50 hr @ 50.00			2.5	2.5	2.5	2.5
h. Boat maintenance			0.5	0.5	0.5	0.5
i. Maintenance of housing, roads			2.0	10.0	10.0	10.0
j. Operation/maintenance generators			2.0	10.0	10.0	10.0
92. <u>OPERATIONS TOTAL (IC)</u>	<u>753.6</u>	<u>65.5</u>	<u>159.7</u>	<u>183.6</u>	<u>172.4</u>	<u>172.4</u>
<u>l. PARTICIPANT TRAINING</u>						
1. 12 mos. English training						
2. 48 months post graduate study						
3. Ph.D. Training						
<u>CONTINGENCY (5% SIMPLE) IC = 69%</u>	<u>41.0</u>	-	-	<u>23.3</u>	<u>8.8</u>	<u>8.9</u>
<u>INFLATION (10% compounded annually)</u>	<u>145.7</u>	-	-	-	<u>61.5</u>	<u>84.2</u>
<u>GRAND TOTAL (IC)</u>	<u>1,480.4</u>	<u>310.8</u>	<u>454.4</u>	<u>206.9</u>	<u>242.7</u>	<u>265.5</u>

7/ 34 months post graduate training.

8/ \$100,000 of Saudi Arabia funds available in FY 76, however prefer to use Saudi funds to supplement U.S. funds where possible. Expect that entire \$300,000 will be expended in CY 77 when funding requirements are clearer.

* Saudi Arabia funds.

ANNEX C - Summary Description of WARDA Activities

WARDA activities are divided organizationally into four main offices: the Research Department, the Development Department, the Documentation Division and the Statistics and Data Processing Division.

(a) Research Department

In accordance with recommendations of the Scientific and Technical Committee and the Steering Committee, the Governing Council of WARDA has established priorities for: setting up a network of standardized, coordinated trials in the region comparing local and improved varieties of rice; establishing coordinated and standardized trials involving fertilizer application and plant protection techniques; and reinforcing selected research stations in the region to conduct applied research and breeding programs for varietal improvement on the four main rice types - upland rice, tidal mangrove swamp rice, irrigated rice, and deep water and floating rice. Implementation of these programs involves an annual rice research meeting attended by representatives of the region and international institutes - the use of consultants for special subjects - and the recruitment of research workers in the region for training.

Under the coordinated trials program which is now completing its third year, "Initial Evaluation Tests" and "Preliminary Variety Trials" are being conducted at about 30 sites throughout the region including the International Institute of Tropical Agriculture (IITA) at Ibadan, Nigeria. The training of field assistants has helped to obtain better uniformity and more reliable results in the conduct of the trials. The seed laboratory, built with AID assistance, was completed in December 1974, and is now distributing seeds for the coordinated trials after testing for germination and purity and treating seeds for nematodes and insect infestation. The Seed Laboratory has its nursery farm at the Liberian Central Agricultural Experiment Station, located at Suakoko. It also cooperates with the Moor Plantation Experimental Station at Ibadan, Nigeria, which acts as quarantine station for all seeds introduced from outside the region. WARDA has recently built an additional three greenhouses and three test cubicles to accelerate the control of seed samples coming from outside the region. WARDA's program to reinforce selected rice research stations is making excellent progress although original estimates of time necessary for project design and implementation had been highly optimistic. With the assistance of IRAT the program of research on rainfed rice at Bouaka in the Ivory Coast is in full swing. With assistance from UNDP, the U.K. and AID good progress is being made in building added capacity for research at Rokupr Rice Research Station in Sierra Leone. With the exception of recruitment of senior scientific personnel, all activities are on schedule and it is planned that research work will reach its full capacity by September 1976 after the completion of all construction activities, the delivery of all commodities and the recruitment of all research personnel. WARDA is currently looking to Canada to provide assistance in building up the research capability in Senegal on irrigated rice.

The means of accelerating research on deep water and floating rice are to be provided by AID with some financial assistance from Saudi Arabia.

The Training Program is one of WARDA's most important activities. With assistance from AID a Training Center is being established in Liberia to train personnel from member countries in rice production, water management, rice processing, managing coordinated trials and other subjects of priority concern to increasing rice production. The emphasis in all cases will be on the training of trainers in order to obtain maximum impact in member countries. The Training Center now under construction will be ready for occupancy by April 1976.

(b) Development Department

This Department collects background information on rice cultivation in West Africa, identifies the constraints to increased rice production and provides follow-up to WARDA's research programs through conducting special studies, designing projects, operating a seed multiplication farm, and organizing special seminars and conferences.

The WARDA report "Development of Rice Cultivation in the Sahel Countries" of June 1975, is an example of a special study for which AID provided the services of an economist. The seed multiplication farm is expected to produce 75 tons of foundation seed in 1976 sufficient to meet about 50 percent of requirements. Consultant services have been extended to all member countries to help design projects, assist in reorganizing extension services and in evaluating on-going projects. Seminars and conferences provide invaluable opportunities for the exchange of information and data. They also stimulate research in marketing, storage, pricing policies and other socio-economic factors dealing with the problem of achieving self-sufficiency in rice in the region.

(c) Documentation Division

Apart from collecting and exchanging documents, the Documentation Division distributes semi-annually to each member country a bibliographic index of documents on rice cultivation in the region. The material is processed by computer and available in microfiche or photocopy form. Also produced semi-annually is listing of world rice references.

(d) Statistics and Data Processing Division

This Division has received substantial assistance from UNDP in the past. Its major product is the Rice Statistics Yearbook. Apart from back-stopping other departments in statistical analysis and data processing, the Statistics and Data Processing Division has met with considerable success in getting member countries to adopt uniform systems and procedures for reporting statistical data although much more still needs to be done.

ANNEX D. WARDA-GOM Agreement.

AGREEMENT BETWEEN THE GOVERNMENT OF THE REPUBLIC OF
MALI AND
THE WEST AFRICA RICE DEVELOPMENT ASSOCIATION (WARDA)
FOR THE IMPLEMENTATION OF THE WARDA REGIONAL RESEARCH
PROJECT ON FLOATING AND DEEP FLOODED RICE.

WHEREAS

article II of the WARDA Constitution provides that

- the Association and its staff, as well as persons attending sessions of its organs in an official capacity, shall be granted in the territory of Member States the immunities, privileges and facilities which may be required for the proper exercise of the functions conferred on them by this constitution or by virtue of decisions taken thereunder by the appropriate organs of the Association,
- the scope of privileges and immunities of the Association, its property, funds and assets and its staff shall be determined, mutatis mutandis in accordance with the provisions of the Convention on Privileges and Immunities of the Specialized Agencies of the United Nations;

WHEREAS

Article IV of the WARDA Constitution provides that the Member States of the Association shall:

- make available training and research facilities and land on such terms and conditions as may from time to time be agreed with the appropriate organ of the Association;
- make available national personnel on such conditions as may be agreed upon by the appropriate organ of the Association;
- supply the Association with such samples of plants, rice, seeds, soil and other material as required;

WHEREAS

Article IX of the WARDA Constitution stipulates that:
 "under the authority of the Governing Council the Executive Secretary shall be responsible for representing the Association in its relations with States and Organizations and entering into contractual relations, on behalf of the Association, with any individuals, corporations or other bodies or entities as may be necessary for the purpose of executing the approved programme of the Association within the limits of the budget of the Association";

WHEREAS

Article X of the WARDA Constitution provides that:

- Member States may be required to make special contributions in kind or cash, in respect of programmes or projects carried out in their territories, the nature and extent of such contributions being determined by the Governing Council by means of agreements entered by the parties concerned;
 - the Association shall have the power to accept gifts, legacies, grants, loans and other contributions in kind or in cash from Governments and International or National Organisations or Institutions and from other sources, provided that such gifts, legacies, grants, loans or other contributions are intended for the furtherance of the purposes of the Association;
 - The Governing Council shall determine, by means of financial regulations or otherwise, the conditions under which the Executive Secretary may accept gifts, legacies, grants, loans and other contributions and enter into appropriate agreements with donors without a special authorisation from the Governing Council,
- and

WHEREAS

Financial Regulation X provides that gifts, legacies, grants, loans or other contributions in kind or in cash..... from Governments and International or National Organizations or Institutions may be accepted by the Executive Secretary.....it being understood that the acceptance of any voluntary contributions which directly or indirectly involves additional obligations for Member States shall in any event require the consent of the Governing Council.

NOW THEREFORE

The Government of the Republic of Mali (hereinafter called "the Government") represented by H.E. Son Coulibaly, Minister of Rural Development and the West Africa Rice Development Association WARDA (hereinafter called "the Association"), represented by Mr. Jacques Diouf, Executive Secretary, hereby agree as follows:

Article 1

The Mopti North Rice Research Station will be the site of the WARDA regional research project on floating and deep-flooded rice, aiming at the development and assistance for spreading the use of high yielding varieties and cultural practices adapted to these types of rice cultivation in West Africa.

Article 2

In view of the implementation of this project and in accordance with Article II of the WARDA Constitution, the Government shall supply

- developed land of an estimated area of 46.5 ha
- the necessary land for the buildings planned under the Phase I of the project, as well as for foreseeable extensions

- one house for the Director of the Station
- one office-laboratory
- three sheds

Article 3

The Government undertakes to put at the Association's disposal, and according to the timetable established by the Association, officers for the following positions:

- five research assistants
- one administrative assistant
- one farm manager
- four field assistants

These members of staff shall be released for one year period, at a time, but on a renewable basis.

The Government undertakes to renew the release of the staff to the Association for as long as this shall be requested. The Government undertakes to take only in case of serious misdemeanor the initiative of withdrawing a staff member. Such staff member shall be replaced promptly taking into consideration his qualification.

Article 4

The Government undertakes to assist the Association in the recruitment of staff in accordance with Malian labour laws.

Staff already employed at the Mopti-Ibetemi station shall, if equally qualified be given priority in recruitment by the Association. To this effect, the Rural Economy Institute will forward to the Association all necessary information (qualifications, age, seniority, salaries, etc.) together with its recommendations, on the staff already employed at Mopti.

Staff transfers from Government service to the

...../

Association shall be effected in such a way that the Association shall not be responsible for the rights acquired by this staff before the transfer: indemnity for the termination of the contract, pension rights, etc.

Article 5

The Rural Economy Institute shall be the Government counterpart service for the project implementation.

The Chief of the Agronomic Research Division of Mali Rural Economy Institute shall be designated as the responsible authority for the coordination of the Government and the Association actions within the framework of the project implementation. As such, he shall participate in all programming, supervision and evaluation activities.

Article 6

The National Directorate of Rural Engineering of Mali shall carry out the rural and civil engineering studies, prepare plans and cost estimates, prepare tenders and select suppliers, and supervise rural and civil engineering works.

It shall submit for the Association's approval the procedures considered most appropriate for the different categories of works to be done.

It shall inform the Association of contracts and tenders, as well as of modification it considers necessary during the implementation of the works. The Association shall inform the Director of Rural Engineering of its decisions, on the basis of the information received.

The Directorate of Rural Engineering shall regularly inform the Association of the progress made and the difficulties encountered.

...../

Article 7

Both parties agree to recognize that it is essential that the Mopti Rice Operation and the WARDA regional research project on deep flooded and floating rice establish close cooperative relations, particularly in the following fields:

- conduct of multilocal trials and of demonstration trials on farmers' fields,
- socio-economic studies in order to make research workers aware of the problems facing the farmers,
- seed multiplication - The research project will have to supply regularly foundation seed to the Mopti Rice Operation and other similar projects. In this respect, it is necessary to have a precise planning, in order to identify the varieties to be multiplied and the quantity of foundation seed to produce.

Moreover, the Mopti Rice Operation and the WARDA regional research project must cooperate in the use, maintenance and repair of equipment and infrastructure.

Article 8

The Association shall undertake to search for the financing required for the investments complementary to the counterpart contribution given in kind by the Government and which was indicated in Article 2 above. This includes in particular:

- five houses for the senior staff, Malian and expatriate
- one guest house
- one office
- three laboratories-offices
- finishing of land development
- pumping equipment

- pumping equipment
- agricultural equipment
- stand-by generators
- transportation equipment
- laboratory and office equipment

The Association shall also undertake to search for the financing of the technical studies and of the supervision of the works.

Article 9

The Association shall undertake to search for the financing of the operational costs of the project; staff and equipment. The first phase of the project shall extend to the end of 1978.

Article 10

The Association shall supply the necessary international staff for the implementation of the project. The Association and its staff shall be granted in the territory of Mali, the immunities, privileges and facilities required for the proper exercise of the functions conferred on them, in accordance with Article II of the Association's Constitution.

Article 11

The Association shall undertake to ensure the necessary training for the Malian research workers who will be placed at its disposal, in order to prepare them to assume the positions of research assistants and, later, to replace the expatriate staff.

Article 12

The Association shall consult with the Government on the matter of salaries and benefits of the Malian staff employed by the project.

...../

Article 13

The Association shall have the right to hand over to the Government any staff member put at its disposal and whose services would not be considered satisfactory. This shall be done by letter, signed by the Executive Secretary, and supported by a detailed report. In such a case, the Government will be required to provide a replacement. Management of the staff governed by the Malian labour laws will be done in accordance with these laws.

Article 14 INTERPRETATION AND ARBITRATION

In accordance with Article XV of the Constitution of the Association, any question in dispute that may arise concerning the interpretation or application of any provision of the Agreement, which cannot be settled by the parties concerned, shall be submitted to arbitration by an Arbitral Commission. The Arbitral Commission shall be composed of three members nominated as follows:

- (i) Each party shall nominate one arbitrator;
- (ii) The third arbitrator, who shall be the President of the Arbitral Commission, shall be chosen by agreement between the arbitrators nominated by the parties.

The decision of the Arbitral Commission shall be binding on the parties.

These provisions shall be without prejudice to the choice of any other mode of settlement that the parties concerned may jointly decide upon.

In case no agreed settlement is achieved, the question shall be submitted to the Governing Council for final settlement.

Article 15 ENTRY INTO FORCE

This Agreement shall enter into force on the date of its signature.

ANNEX E - Waivers and Local Costs1. WAIVERS

a. A procurement source waiver under M.O. 1412.1 is recommended to permit the selection of a local or geographic code 941 (Selected Free World) firm(s) to perform the construction services required for the construction and improvement of the Mopti-North Research Station, including the housing area .

Construction under the WARDA-Mopti Activity, amounting to \$753.0 thousand (exclusive of GOM engineering services), is probably not suitable for U.S. bids. There are no U.S.-owned or controlled construction firms in Mali or that commonly do business in Mali. The relatively small size of the construction element (compared to the amount that would normally be expected to elicit U.S. bids), the relative inaccessibility of Mopti and the absence of U.S. firms in Mali have cost implications which make it improbable that U.S. firms could submit competitive bids. While Invitations for Bids (IFB) will go to U.S. sources, simultaneous IFBs should go to local construction firms in order to prevent possible construction delays.

b. A waiver of AID Regulation 7 restrictions on financing the costs of construction work performed by third country nationals (TCN) is recommended.

The local Malian construction firms which are most likely to bid successfully on the project often employ third country nationals in technical positions. This waiver is needed to permit the best Malian firms to bid on the project and to construct the research station facilities to required specifications.

c. A waiver of Section 636(i) of the FAA, as amended, which requires that AID financing be restricted to motor vehicles manufactured in the United States is recommended for two sedans, one pick-up truck and one 4-ton truck. These vehicles, valued at an estimated \$31,000, are required for senior scientists' use and for transport of agricultural farm inputs, produce and other commodities related to the experimental program.

U.S. vehicles are not suitable for use in Mali where spare parts and maintenance service are not available for U.S. vehicles. Parts and service are available for French and Japanese supplied vehicles. The four project vehicles would probably be supplied by dealers in neighboring Ivory Coast, from French or Japanese sources.

The absence of this waiver would be harmful to the interests of the project and consequently, harmful to the interests of the United States. Previous AID funded projects in Mali and in other of the poorest Sahelian States have customarily waived 636(i) on the basis of this rationale.

d. A waiver of procurement source and origin requirements in Handbook 15 for grant funded commodities is recommended from Code 000 (U.S.) to, in part, Code 935 (Special Free World) and in part, Code 941 (Selected Free World) for building products and materials valued at an estimated \$240 thousand; and to Code 935 for scientific instruments and laboratory equipment valued at an estimated \$35 thousand. The building products and materials will be used in the construction of scientists' housing, laboratories, offices, green house and a screen house and other facilities at the Mopti-North Research Station. Of the estimated total \$780.0 thousand allocated to this construction, an estimated \$240 thousand is expected to represent imported products and materials including fixtures, plumbing systems, electrical systems, window frames, reinforcing material, etc. U.S. materials are generally not suitable for building construction in Mali nor are they available thru Malian construction industry procurement channels.

All government construction in the country (including research facilities) is built to standardized Government of Mali (GOM) specifications, incorporating local and imported materials available locally. GOM specifications are derived from French systems. U.S. supplied plumbing, electrical, and other building materials would be incompatible with the Malian systems already existing at the Mopti-North Research Station. Maintenance for U.S. source products would be difficult in the absence of trained service personnel and parts.

Failure to waive requirements for U.S. source grant funded commodities would greatly increase local construction costs and delay the research station construction. Local firms, unfamiliar with U.S. products and with no regular source of supply for such products would find their costs increased by the complexities related to procurement and use. It is likely that local firms would not be able to cope with necessary adjustments involved in the use of U.S. products and materials -- in procurement, staffing, training, planning and use.

A portion of the \$240 thousand for imported materials are expected to be European source, with the balance from Code 941 countries in West Africa. As part of the REDSO/WA approval of the WARDA-Mopti bidding and contract process, the procurement of building materials from European Source will be minimized to essential needs while U.S. and 941 procurement will be required to the maximum extent possible.

A \$35,000 waiver is requested for procurement of scientific instruments and laboratory equipment. (\$35,000 represents fifty percent of the total Mopti-Activity expenditure for instruments and lab equipment.) This waiver is necessary to permit the procurement for Malian scientists of equipment with which they are familiar and competent. Waiver has not been requested for the full value of the lab equipment because U.S. lab equipment should be suitable for a substantial portion of the needs.

2. LOCAL COST

Local costs are estimated at \$1480.4 thousand, or 54 percent of total costs for the WARDA-Mopti Activity. Refer to Annex B, Table 2 for a detailed local cost breakout. Principle local cost elements are estimated as follows:

	(\$000)
I. <u>Construction</u>	<u>540.1</u>
1. Housing (site development; scientists' housing)	368.9
2. Experimental Station Buildings	85.1
3. Hydraulic Infrastructure at Experimental Station (land leveling; construction of interior dikes, irrigation and drainage ditches, water control gates)	59.0
4. Engineering; Construction Supervision	27.0
II. <u>Operating Costs</u>	<u>753.2</u>
1. Personnel	407.2
2. Housing rental	54.0
3. Travel/study	35.0
4. Office supplies	48.7
5. Laboratory supplies	44.0
6. Experimental farm supplies	164.0
III. <u>Infla tion plus Contingencies</u>	<u>186.7</u>
(local cost set-aside)	
GRAND TOTAL (local costs)	<u><u>\$1,480.4</u></u>

Local cost components of construction are estimated at 65 percent of the value of construction for most buildings. These local costs include local labor, local building materials, the use of equipment services, and local engineering and supervisory services.

Regarding "II. Operating Costs," these represent research station operating costs including local staff salaries and local procurement of expendible research station supplies and materials.

Contingency and inflation factors have been pro-rated and set aside for local costs.

The level of local costs is appropriate considering the nature of the project activity to develop regional African rice research capability in a technically and ecologically important but isolated region of the Sahel. Relatively large local inputs toward construction and research station operation are required.

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Department of State

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ID AMEMBASSY BAMAKO

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ACTION TO: AFR/RA
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SUBJECT: WARDA - MOPTI-NORTH ACTIVITY ECRP REVIEW

REF: STATE 079630

1. BECAUSE REDSO/WA ENGINEER, MOSES MORGAN, ASSISTED ON ENGINEERING DESIGN USAID REQUESTS REDSO SATISFY REQUIREMENTS SECTION 611 (A) AND CABLETEXT TO AID/W.
 2. USAID HAS NO HESITATION COMPLYING WITH SECTION 611 (E) CERTIFICATION REQUIRED FOR PROJECT APPROVAL AND TRANSMITS TEXT PARA 4 BELOW. IT IS URGENT THAT PROJECT BE APPROVED SO THAT FY-1976 FUNDS CURRENTLY AVAILABLE IN AMOUNT \$25,000 CAN BE UTILIZED FOR PRELIMINARY START-UP ACTIVITIES AT MOPTI RESEARCH STATION INCLUDING, PARTICULARLY, EMPLOYMENT OF RESEARCH ASSISTANTS WHO COMPLETE THEIR TRAINING IN JUNE, 1976. PROJECT APPROVAL WILL ALSO PERMIT WARDA UTILIZE FUNDS AVAILABLE FROM SAUDI ARABIA WHICH CONSIDERED ADEQUATE R
- V
- USAID TO INITIATE NEGOTIATIONS ON A&E CONTRACTS FOR CONSTRUCTION WORK. IT WILL ALSO PERMIT WARDA TO INITIATE RECRUITMENT ACTIONS FOR EMPLOYMENT SENIOR PERSONNEL WHO MAY BE HARD TO FIND. WARDA HAS NECESSARY CAPABILITIES TAKE ABOVE PRELIMINARY STEPS PRIOR TO FULL PROJECT IMPLEMENTATION IN FY-1977. USAID CONCERN EXPRESSED PREVIOUS MESSAGES PERTAINS TO WARDA'S HUMAN RESOURCE CAPABILITY TO DEAL EFFECTIVELY WITH IMMEDIATE AND FULL INITIATION MOPTI PROJECT BEFORE



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COMPLETION CONSTRUCTION AND START-UP PHASES OF ROKUPR AND TRAINING CENTER PROJECTS WHICH WILL REQUIRE ANOTHER 3-4 MONTHS.

3. TEXT OF CERTIFICATION PURSUANT TO SECTION 611 (E) OF THE FOREIGN ASSISTANCE ACT OF 1961 AS AMENDED FOLLOWS (COPIES WILL BE POUCHED AID/W SOONEST): BEGIN QUOTE

I, STANLEY J. STEGEL, DIRECTOR OF THE USAID MISSION TO LIBERIA, DO HEREBY CERTIFY THAT IN MY JUDGEMENT THE WEST AFRICA RICE DEVELOPMENT ASSOCIATION WILL HAVE THE FINANCIAL CAPABILITY AND THE HUMAN RESOURCES CAPABILITY TO IMPLEMENT AND UTILIZE EFFECTIVELY THE SUBJECT GRANT ASSISTANCE. THIS CERTIFICATION TAKES INTO CONSIDERATION THE REQUIREMENTS PLACED PREVIOUSLY AND PRESENTLY ON WARDA TO MAINTAIN AND UTILIZE OTHER ACTIVITIES PREVIOUSLY FINANCED OR ASSISTED BY THE UNITED STATES; TO-WIT:

1. AN EVALUATION OF WARDA ACTIVITIES CONDUCTED IN SEPTEMBER, 1975 DETERMINED THAT U.S. FINANCED ACTIVITIES WERE PROGRESSING ACCORDING TO SCHEDULE.
AND

2. THE COMPLETION OF CONSTRUCTION AND START-UP PHASES OF OTHER ACTIVITIES PREVIOUSLY APPROVED BY AID WILL BE REALIZED WITHIN THE NEXT 3 - 4 MONTHS PERIOD FOLLOWING WHICH WARDA RESOURCES CAN BE DEVOTED TO FULL IMPLEMENTATION OF ASSISTANCE UNDER THE SUBJECT GRANT.

SIGNED - STEGEL

APRIL 7, 1976. END QUOTE.
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