

FD 13 AX 155

124

AGENCY FOR INTERNATIONAL DEVELOPMENT

PROJECT DATA SHEET

1. TRANSACTION CODE

C A = Add
C = Change
D = Delete

Amendment Number

2

DOCUMENT CODE

3

2. COUNTRY/ENTITY
Mali

3. PROJECT NUMBER

688-0206

4. BUREAU/OFFICE

Africa

05

5. PROJECT TITLE (maximum 40 characters)

Action Riz Sorgho

6. PROJECT ASSISTANCE COMPLETION DATE (PACD)

MM DD YY
05 01 85

7. ESTIMATED DATE OF OBLIGATION
(Under "B." below, enter 1, 2, 3, or 4)

A. Initial FY 82

B. Quarter 3

C. Final FY 83

8. COSTS (\$000 OR EQUIVALENT \$1 =)

A. FUNDING SOURCE	FIRST FY 82			LIFE OF PROJECT		
	B. FX	C. L/C	D. Total	E. FX	F. L/C	G. Total
AID Appropriated Total						
(Grant)	(230)	(341)	(571)	(440)	(650)	(1090)
(Loan)	()	()	()	()	()	()
Other U.S.						
1.						
2.						
Host Country						419
Other Donor(s)						
TOTALS						1509

9. SCHEDULE OF AID FUNDING (\$000)

A. APPROPRIATION	B. PRIMARY PURPOSE CODE	C. PRIMARY TECH CODE		D. OBLIGATIONS TO DATE		E. AMOUNT APPROVED THIS ACTION		F. LIFE OF PROJECT	
		1. Grant	2. Loan	1. Grant	2. Loan	1. Grant	2. Loan	1. Grant	2. Loan
(1)				3878			1090	4968	
(2)									
(3)									
(4)									
TOTALS									

10. SECONDARY TECHNICAL CODES (maximum 6 codes of 3 positions each)

11. SECONDARY PURPOSE CODE

12. SPECIAL CONCERNS CODES (maximum 7 codes of 4 positions each)

A. Code

B. Amount

13. PROJECT PURPOSE (maximum 480 characters)

To increase cereal production/reduce cereal losses in the Gao area and to introduce the farmers in the area to the concept of technological development.

14. SCHEDULED EVALUATIONS

Interim MM YY MM YY Final MM YY
05 83 05 85

15. SOURCE/ORIGIN OF GOODS AND SERVICES

000 941 Local Other (Specify) 899

16. AMENDMENTS/NATURE OF CHANGE PROPOSED. (This is page 1 of a page FP Amendment)

17. APPROVED BY

Signature

Title

Acting Director, USAID/Mali

Date Signed

MM DD YY
3 18 82

18. DATE DOCUMENT RECEIVED IN AID/W, OR FOR AID/W DOCUMENTS, DATE OF DISTRIBUTION

MM DD YY

DRAFT AUTHORIZATION AMENDMENT

Name of Country: Mali
Name of Project: Action Riz-Sorgho
Project Number: 688-0206

1. Pursuant to Sector 121 of the Foreign Assistance Act of 1961, as amended, the Action Riz-Sorgho Project for Mali was authorized on September 27, 1976. That authorization was amended on May 15, 1980, and is hereby further amended as follows:
 - (a) The life of project funding is increased by \$1,090,363 from \$3,878,000 to a total not to exceed \$4,968,363.
 - (b) The life-of-project is extended by three years to March 31, 1985.
 - (c) The authorized source and origin of goods and services, except for ocean shipping under the project, shall be in the Cooperating Country and in countries included in AID Geographic Code 941, except as AID may otherwise agree in writing.
 - (d) The Project Agreement Amendment which may be negotiated and executed by the officers to whom such authority is delegated in accordance with AID regulations and Delegations of Authority should be subject to the following essential terms and covenants and major conditions, together with such other terms and conditions as AID may deem appropriate.
2. Prior to any disbursement for water pumps or to the issuance of any commitment documents therefor under the amended project agreement, the Cooperating Country shall furnish in form and substance satisfactory to AID:
 - (a) Evidence that the revolving fund which has been established to contain the proceed of the rental of project water pumps contains sufficient funds to cover the operating costs of all existing water pumps, including amortization costs and the procurement of necessary spare parts and
 - (b) Evidence that the existing project water pumps are being adequately serviced by ARS and that an adequate supply of spare parts therefor is on hand.
3. The authorization cited above, as previously amended, remains in force except as hereby further amended.

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It is found that special circumstances exist which justify a waiver of the requirements of Section 636 (1) of the Act, as far as the Land-Rov vehicle is concerned.

In addition, a proprietary procurement waiver is justified on the basis of service availability and dependability, and in accordance with the criteria set forth in HB15, 3C3b (4).

B- A source/origin waiver from AID Geographic Code 941 to 935 is requested to purchase one 25Kva generator and one fuel tank pump.

- one generator, 25Kva : \$10,000
- one fuel tank pump : \$16,000
- probable source : France, Italy, Spain, UK

1) Generator, 25Kva: The generator is needed for the new building housing the Project head offices as soon as the Project Agreement is signed. For several years, there has been no dependable power supply in Gao and there is no indication that the situation will improve in the years to come. The generator will provide lighting and power for air-conditioners, fans, calculators, typewriters, one SR radio etc. and will thus hopefully improve the working environment, productivity and the overall morale of the project staff. Previous requests for waivers gave reasons why U.S. makes are not acceptable: delays in delivery, unavailability of parts and lack of after sales services...

2) Fuel tank pump: The fuel tank pump will permit a better fuel supply and control system, especially if equipped with a metric meter. U.S. made pumps are not so made and are therefore not suitable.

The source/origin waiver is therefore justified in accordance with criteria set forth in chapter 5B4b (1) and (2) of HBI, supplement B.

D R A F T

AID PROJECT No 688-0206

PROJECT AGREEMENT AMENDMENT

between

THE GOVERNMENT OF THE REPUBLIC OF MALI

and

THE UNITED STATES OF AMERICA

for

ACTION RIZ-SORGHO

Dated:

Appropriation:

Allotment:

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Amendment No. 4, dated _____ between the United States of America, acting through the Agency for International Development ("AID") and the Republic of Mali (Grantee) for the Action Riz-Sorgho Project.

Whereas the Grantee and AID entered into a Grant Agreement dated March 30, 1978 ("Agreement") and amended that Agreement on December 2, 1978, August 29, 1979 and May 31, 1980, whereas Grantee and AID desire to further amend the Agreement to reflect an extension of the life of project and modifications in the direction of project focus;

Now therefore, the parties hereto hereby agree that the Agreement shall be further amended as follows:

1. Section 2.1, Definition of the Project, is changed to reflect that the authorized representatives of the Parties are named in Section 8.2, not Section 7.2.
2. Section 2.2, Incremental Nature of Project, is eliminated.
3. Section 3.1, the Grant, is amended to delete \$2,873,000 and insert in lieu thereof _____
4. Section 3.2, Grantee Resources for the Project, paragraph (b) is amended to delete \$1,463,000 and insert in lieu thereof _____
5. Section 3.3, Project Assistance Completion Date, is amended to delete March 31, 1982 and insert in lieu thereof March 31, 1985.
6. Articles 4 through 7 are renumbered Articles 5 through 8.
7. New Article 4, Conditions Precedent to Disbursement, is added as follows:

Section 4.1. Disbursements for Water Pumps. Prior to disbursements under the amended Grant for water pumps, or to the issuance by AID of documentation pursuant

to which such disbursements will be made, the Grantee will, except as the parties may otherwise agree in writing, furnish to AID in form and substance satisfactory to AID:

(exact language from Authorization amendment, as signed).

8. Old Article 4, New Article 5, special Covenants is amended to add paragraphs (9) through (0) as follows.
(Covenants as rewarded by USAID).
9. Section 1 of Old Article 5, New Article 6, Procurement Source, shall be amended to delete quote in the United States unquote and insert in lieu thereof quote countries included in Code 940 of the AID Geographic Code Book as in effect at the time orders are placed on contracts entered into for such goods and services unquote.
10. Old Annex I, Amplified Project description is deleted and the attached new Annex is substituted therefor.

Except as amended herein, the Agreement as previously amended between Grantee and AID, remains in full force and effect.

(attach new Annex I & Budget)

b

ACTION MEMORANDUM FOR THE ASSISTANT ADMINISTRATOR FOR AFRICA

From : AAA/AFR/DR, John W. Koehring

Subject: Mali - Action Riz-Sorgho (688-0206): Proprietary Procurement Waiver and Source/Origin Waiver for Water Pumps

Problem: Your approval is requested to permit the procurement of twenty (20) Bernard diesel water pumps of non-U.S. manufacture for the Action Riz-Sorgho Project. This requires a proprietary procurement waiver and a source/origin waiver from AID Geographic Code 000 (U.S. only) to AID Geographic Code 935 (Free World).

A. Cooperating Country : Mali
B. Authorizing Document : Project Paper Amendment
C. Project : Action Riz-Sorgho
D. Project Number : 688-0206
E. Nature of Funding : Grant
F. Description of Goods : 20 Bernard Diesel Water Pumps (6 hp)
G. Approximate Value : \$60,000
H. Probable Source : Mali or France
I. Probably Origin : France

Discussion: The Action Riz-Sorgho Project was approved in 1976; the objective of this project is to increase production of rice and sorghum grown along the Niger River in the Seventh Region of Mali (the Gao area). The project has introduced several interventions which have helped increase rice yields in the area, including the construction of insubmersible dikes, the provision of agricultural inputs (fungicides, fertilizers, etc.), and 16 water pumps. The 16 pumps procured under the project and rented to farmers are French manufactured Bernard 4 and 6 horsepower diesel pumps. The procurement of these 16 pumps required a waiver, which is attached hereto.

Because the pumps are being obtained for use by the farmers, they must be transported every day during the growing season from field to field. Therefore, they must not be too heavy to move about freely. Indian manufactured pumps financed under the Mali Action Blé Project (which were considered for use in this project) weigh well over 200 lbs. and are thus not a viable alternative.

Unlike the Action Blé Project, which purchased 500 pumps, the subject project will be financing only 20 additional pumps to be used for rental purposes. The Bernard pump is the only pump that the ARS serviceman knows how to repair and the only one with which the Gao farmers are familiar. It would cause ARS great problems to have to stock spare parts for two different makes of water pumps. Thus for purposes of facilitating spare parts procurement and repair, procurement of the same kind of pump (a Bernard diesel 6 hp) is required.

Primary Justification: The water pumps are essential to the successful and timely implementation of this project, and no pumps of appropriate type are available from the U.S. or Code 941 countries.

Recommendations: For the above reasons, it is recommended that you approve a waiver to permit the procurement of 20 French manufactured water pumps for the Action Riz-Sorgho Project, and a proprietary procurement waiver to permit the procurement of Bernard water pumps, and certify that exclusion of procurement from Free World countries other than the cooperating country and countries included in Code 941 would seriously impede attainment of U.S. foreign policy objectives and objectives of the foreign assistance program.

APPROVED _____

DISAPPROVED _____

DATE _____

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I. PROJECT SUMMARY AND RECOMMENDATION

A. Recommendation

USAID/Mali recommends the approval of this Project Amendment for the Action Riz-Sorgho Project (688-0206), providing an additional \$1,090,363 funding. This amendment will bring total project funding to \$4,968,363.

USAID/Mali also recommends the approval of the source/origin and proprietary waiver included as Annex A; an extension of the project by three years until March 31, 1985, to allow a gradual phase out of AID's participation in the project; and that the authorized source/origin Code 000 be changed to Code 941 for the amended project.

B. Project Summary

The Action Riz-Sorgho Project was designed primarily to assist farmers producing rice and sorghum along the Niger River in the chronically grain-deficit area of Gao (now the Seventh Region), Mali, to increase their production of both crops, thereby reducing the region's dependence on imported grain from other areas including, not infrequently, the United States under its PL 480, Title II Program. Action Riz-Sorgho (ARS) is the Government of the Republic of Mali's (GRM) agricultural development agency in the Seventh Region for promoting rice and sorghum production and is the agency through which AID has worked to increase the production of these crops in the area. AID funds have been used by ARS to construct a research station, to construct insubmersible dikes with water and fish control gates and screens, to repair submersible dikes, and to provide extension services, including the introduction of new seed varieties and water pumps.

AID financing for the project will run out at approximately the end of February, 1982. The project was evaluated in the spring of 1981 to help determine whether or not American assistance should continue. The evaluation recommended that AID funding be continued for several years so as "to assure the farmer of a crop, primarily by providing him access to water pump rental, and test and develop a set of technical interventions proven to fit climatic, economic, and social conditions." Action Riz-Sorgho Project Evaluation, dated April, 1981, p. 27 (the Evaluation). This project amendment incorporates most of the evaluation team's recommendations, including those involving a reduction of ARS' operating expenses and a transfer, wherever possible, of its activities to the private sector, in particular, to cooperatives.

In addition to addressing the evaluation recommendation, this project extension will allow a rational phase out of USAID support to Action Riz-Sorgho. The proposed extension will accomplish this by building on the three major accomplishments of the project: (1) the construction in a remote area of Mali of dikes, complete with flood gates and fish screens, protecting more than 1,300 hectares of rice polders; (2) the establishment of an agricultural development agency which is extending agricultural services and products to farmers; and (3) the construction of a research station that is ready to conduct significant research.

C. Project Strategy

1. Evaluation Report. Before a discussion of the project amendment strategy begins, the recommendations of the evaluation team should be noted:

a. Reorientation of ARS' role so as to "be one of supporting research, providing technical counsel through extension, training of extension agents and executing demonstrations which support extension advice;" and termination of the distribution of seed, fertilizers, etc. in those villages where cooperatives have agreed to do the distribution. Evaluation, pp. 27 and 32;

b. Carrying out multi-purpose research, testing both floating and standing varieties of rice as well as animal traction, with the technical assistance of a rice agronomist;

c. Training extension personnel and farmers at the research station;

d. Associating extension agents with a local cooperative, if the cooperative so wishes, thereby enhancing their respect and effectiveness in the community;

e. Conducting both research and demonstration plots in farmers' fields so as to enhance the flow of information between farmers and the research station; and finally,

f. Reducing ARS' operating costs, Evaluation, pp. 27-32.

2. Changes in Project Strategy. The original two-fold project purpose "(i) to increase cereal production in the chronically grain deficit Gao area, and (ii) to introduce the farmers to the concept of development through technological advances," remains unchanged. However, the project strategy will be changed in that considerably more emphasis will be placed on (a) research/extension than on infrastructure and (b) institution building by concentrating AID efforts on financing fewer sectors in the Seventh Region, and by meshing ARS' activities with other rice production efforts in the area, in particular irrigated rice schemes which will likely be financed/constructed by the French, and with the cooperative movement.

The French aid program, Caisse Centrale de Coopération Economique (CCCE), is in the process of designing, and will most likely approve in the near future a project loan to the GRM to construct a 30 hectare irrigated rice scheme in the village of Forgho, 15 miles north of Gao, as well as a 30-70 hectare scheme in Tacherane, which is 13 miles south of Gao and one of the two villages where insubmersible dikes were constructed under the present project. Land will be levelled and canals dug so that there will be complete water control and irrigated (standing) rice planted therein. This is advantageous because irrigated rice can be expected under completely controlled irrigation to yield 4 tons paddy per hectare. Presently, only floating rice varieties are planted in the Gao area because the land is not level and water control is not complete; their maximum yields are 1.8 tons paddy per hectare, and average yields are far less.

The CCCE program is experimental; it will work through the cooperatives in Forgho and Tacherane to test the feasibility of operating a complete water-control

irrigated rice production scheme. If it proves successful after a 5 year test period, it is envisioned that additional schemes will be undertaken. The program lacks two ingredients--research in irrigated rice varieties and agricultural extension agents to train the farmers. CCCE has expressed great interest in using the ARS agents to help them train the cooperative members/farmers, and it hopes the ARS research station will do work on both irrigated rice varieties and animal traction. (If ARS' research program does not receive financing, the CCCE will simply import rice varieties being used in irrigated schemes immediately to the south, in Niger.) Because of the CCCE program, ARS' research program on rice (both irrigated and floating varieties) and animal traction, which began on a very limited scale last year (1981), takes on added importance. Research is thus a major component of the proposed 3 year extension of the project.

In addition, because the Evaluation recommended reducing ARS' operating costs and discontinuing AID financing after the proposed 3 year extension, the project will concentrate on 4 sectors in the Seventh Region instead of the present 7. This should allow ARS to improve the quality of its work. The recommended sectors are Gao itself and those where AID has already constructed insubmersible dikes (Tacherane and Gargouna) as well as Forgho, since the CCCE will be working there as well as in Tacherane. In addition, the selection of these sectors makes sense logistically because they are the easiest and least costly for ARS to cover. (They are a maximum of 15 miles from Gao.)

Regarding the relatively new cooperative movement in the Seventh Region, the cooperatives in Tacherane and Forgho are just beginning and are involved only in buying, storing and selling rice for consumption (plus some small consumer items) at very favorable prices to the farmers/villagers, while making a 20% mark-up on the transactions. In other villages outside the project area, however, they are also involved in (a) buying, storing and selling rice paddy seed for planting purposes, (b) constructing water and fish control gates and screens for submersible dikes, and (c) forming women's artisan groups for making and selling various crafts, especially mats. Under this proposed extension, ARS would collaborate with the local cooperatives. Specifically, ARS would provide technical services for their seed program, their fish and water control gate construction program, and to women's groups. At the same time, ARS would, wherever possible, turn over to the local cooperatives some of its services.

D. Project Issues

1. Recurrent Cost. The Evaluation recommended that ARS reduce its staffing so as to reduce operating expenses and that it focus on adaptive ag research and on increasing the quality of its work. To these ends, under the Project Amendment, the project area will be reduced in size to the 4 sectors named above. The number of ARS staff/agents eligible for primes will thus be reduced. These steps will allow ARS to concentrate its efforts and resources on a smaller area. The Amendment includes a covenant specifying that ARS will use AID funds in only these 4 sectors.

2. Feasibility of Water Pump Rental. Under the amended project, ARS will continue purchasing water pumps to be rented out to farmers in the sectors of Tacherane, Gargouna and Forgho. (In the Gao sector, merchants may already rent out enough water pumps.) It should be pointed out that there will

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be relatively few pumps in this activity and that part of the purpose of such a plan is to test on a small scale their economic viability. Their economic viability depends greatly on their being kept in good repair, which ARS has not done well to date according to the Evaluation. To allow the GRM to establish an effective program for pump rental, including the establishment of effective systems for maintenance, repair, rental collection/accounting and general record-keeping, the first year will be devoted to establishing these systems and testing the financial and economic feasibility of the program. Assuming these efforts are successful, an additional 20 pumps will be procured (locally), and the program will be expanded during the second and third years of the project. Finally, the Amendment contains a recommended waiver (Annex A) for the purchase of Bernard pumps from France, identical to the 16 pumps purchased previously by the project, since these are the only kinds of pumps which the ARS pump repairman knows how to repair and which the farmers are familiar with.

3. ARS Collaboration with the Cooperative Movement. Under the amended project, ARS will be encouraged to intensify its collaboration with the private, nonstate cooperatives in the Seventh Region as a means of reducing ARS' activities and operating expenses, as well as a means of enhancing the relations of ARS agents with the farmers. In particular, the Amendment follows the advice of the Evaluation team by terminating AID financing of ARS' program of importing rice seed from Mopti, which has not proven to be superior to the local varieties. AID financing instead concentrates on rice varietal research, including tests of varieties brought in from elsewhere. The Amendment recommends that ARS encourage the cooperatives to implement their paddy rice granery program in all cooperatives in the project area, and a \$20,000 fund has been included in the project budget which ARS could lend to these cooperatives, if necessary, to encourage them to do so. The ARS agents would be the cooperatives' technical advisors regarding seed purchase, storage, etc.--something the cooperatives have stated an interest in. In those villages where there are no cooperatives or for one reason or another the cooperatives do not install such a program to ARS' and USAID's satisfaction, ARS could use these funds to start its own similar program. (If the cooperative's program seems to small to satisfy ARS and USAID, ARS could supplement the cooperative's revolving fund used for seed purchases.)

In addition, the Amendment proposes to assist ARS in collaborating with the cooperatives by establishing a \$50,000 fund which ARS could make available to them to construct canals or water and fish control gates and screens for submersible dikes. This level of collaboration has already begun: in one village outside the project area the cooperative provided the labor, the central cooperative movement (cooperation) provided the funds, and ARS' engineer designed the gates and supervised the work. The project was a success. One problem, which this Amendment attempts to address, is that there are insufficient funds to do a significant number of additional projects. At an average cost of \$10,000 per gate/screen, ARS could finance 5 such projects--with no management responsibilities whatsoever on ARS in those villages where cooperatives exist. Finally, the Amendment proposes to finance, on an experimental basis only, 3 grinding mills for use by the women's groups associated with the cooperatives, which would pay the ARS repairmen for necessary maintenance work. With respect to all of the foregoing suggested collaborative programs with the cooperatives, the cooperative officials in Gao have expressed great interest and concurrence, especially since the local cooperatives would have total management responsibility.

A brief description of how the cooperatives work is included in Annex C. The cooperatives are new in the sectors of Tacherane, Gargouna, Gao, and Forgho, and they are being formed mainly to keep consumer prices down. Their primary programs are in loans to cattlemen and fishermen, medicine, functional literacy, reforestation and, above all, selling consumable items. They are not being formed for the purpose of augmenting agricultural production. The only programs they envisage for themselves relating to agricultural production are the seed granery program and the water gate/fish screens construction program. The Evaluation's suggestion that the cooperatives take over ARS' job of selling plows, fungicides/insecticides, fertilizers, etc. is not possible at this time. The cooperatives are not selling agricultural inputs. Nor do they have the expertise or staff to train farmers in new agricultural methods. On the other hand, the several possibilities for their assuming some of ARS' functions are being fully exploited in this Project Amendment.

4. ARS Research in Irrigated Rice. Under the amended project, ARS (with appropriate technical assistance) will conduct research in irrigated and floating rice varieties and animal traction. Irrigated rice research has been added because of its potential use by the proposed CCCE-financed irrigated rice projects in Tacherane and Forgho. In addition, the CCCE has expressed interest in using the ARS agents in these two sectors for instructing farmers in planting irrigated rice. The ARS agents would be trained in such instruction at the ARS research station, each agent spending one year at the station. If the research and the agents prove useful, it is likely that the CCCE would want to finance the research/agents when AID financing terminates three years hence. This is a principal reason for including Forgho and Tacherane in the 4 sectors to be fully financed by AID, and for encouraging ARS to concentrate its efforts on fewer sectors and improving the quality of its work. While the CCCE has not made a final decision regarding financing of the Forgho and Tacherane irrigated rice schemes, the engineering plans are being finalized by Genie Rural (Mali's engineering institution within the Ministry of Rural Development), and the chances for approval appear excellent.

Even if the proposed program were not eventually realized, and AID funding were terminated at the end of 3 years, the proposed 3 year extension would not be wasted. The economic analysis (Section IV) shows that the non-research components of this project extension are economically viable in terms of production increases. As for the research phase, which is being conducted in collaboration with Mali's research institute (IER), it would most likely be continued by IER, and would benefit other potential donor-financed programs in the Gao area. To drop the research component of this project (which is over one-half the total AID cost of this Amendment, even if only one-quarter of operating expenses were allocated to it) just when the infrastructure for the research station has been installed and finalized would seem to be wasteful and unwise. In addition, the submersible dikes which AID financed in Tacherane and Gargouna are both in the proximity of the research station and could profit greatly from the research. The Evaluation concurred in this assessment.

5. Local Language Capacity of ARS Agents. The Evaluation, p. 13, states that "a communication or attitudinal problem exists between the ARS administration and the farmer in the project area." One reason for this is that "some extension personnel do not speak Songhai, rendering them useless at the

local level." Evaluation, p. 14. To correct this situation, \$6,000 has been included in the project amendment training budget for hiring villagers to teach the agents Songhai. In addition, the Amendment proposes that at the end of one year's additional funding, only those agents (in the three sectors eligible for receiving primes) who are functional (speaking only) in Songhai may receive primes.

II. PROJECT DESCRIPTION

A. Background - Seven Problems to be Addressed by Amendment

1. Need for Research. To date, the primary emphasis of the project has been on completing infrastructure, including the dikes, the ARS headquarters, and the research station. Little time has been spent on research. Partly as a result of this situation, the ARS agents presently have little to extend beyond the relatively successful fungicides and insecticides for seed treatment. The "improved" variety seeds (rice and sorghum) from Mopti have not proven superior to local varieties, and the program is costly. Local varieties, on the other hand, have not responded well to fertilizer. Although animal traction is not widely practiced in the area, demand seems to be growing. Virtually no research has been done in any of the above-mentioned areas. Further, there is insufficient knowledge of the production systems used by farmers in the area. Given this situation, the need to commence research in the above areas is critical.

The present cropping system has only limited potential for improvement. The potential yields of floating rice are poor (1.7 tons/ha) when compared to those of irrigated rice (4 tons/ha). Actual yields for floating varieties are on average only about one-third to one-half of potential yields. The difference between yield potential of the two is further emphasized by the fact that there is a significant amount of land along the river that could be irrigated in the dry season, thus allowing double cropping. This could increase production (to 5-8 tons/ha) and incomes significantly, especially since farm gate prices in Gao are much higher than in the rest of Mali. No research has been done on irrigated rice in the Gao area, even though the CCCE most likely will be financing irrigated schemes in 2 sectors within the project area. Moreover, it is not known to what extent farmers would be willing to change their cultural habits in order to get these superior yields. All of this presently needs testing.

2. Need for Pumps. Because of inadequate water and rain when the plants are germinating or are very young, yields frequently continue to be disastrous even where insubmersible dikes are located. The project initially relied on significantly increased transplanting of floating rice varieties to confront this problem. The original project paper therefore rejected the use of water pumps. As the Evaluation points out, this was a miscalculation. Supplementing the rainfall in July-August is critical. Realizing this, ARS purchased 16 pumps, but has given insufficient attention to their repair. Significantly, the economic analysis suggests pumps can be economical if properly used and kept in good repair. The Cooperation will not be in a position to implement a water pump program in the near future. Therefore, it would very much like ARS to implement such a program for several years so as to observe the results.

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3. Need for Additional Submersible Dikes. In those areas unprotected by dikes, yields are frequently disastrous because of damage to plants by fish and the inability to control the water level when there is an adequate supply. While the insubmersible dikes at Tacherane and Gargoua are benefitting farmers by decreasing fish damage and allowing them to plant in a more timely fashion (due to less work needed to repair the dikes), they were costly and cannot be duplicated elsewhere without significant donor assistance. However, yields can still be significantly increased if the submersible dikes are kept in better repair and fish and water control gates are installed. This is particularly true of the sectors of Gao and Forgho where there are only submersible dikes. The gates are not expensive (about \$10,000 each) and are clearly economically viable, as the SATEC study referred to in the Evaluation shows. The only problem for the villagers is lack of funding for cement, etc. (this is one of the very poorest areas of Mali), and lack of an engineer to design/supervise the construction.

4. Need for Mills. The single greatest complaint by women in the project area is the significant time (3-4 hours/day according to Putman Report) required each day to make flour out of sorghum or to de-hull the rice. In Gao, lessening this time means more time for women to make mats. Putman's report shows that the income from this latter activity contributes significantly to family incomes in the project area. Almost all women in the villages are involved in mat making; the Sixth and Seventh Regions of Mali are somewhat unique in this respect. Thus, any way to increase women's mat making time will ultimately increase their incomes. As a result, the Cooperation is very interested in collaborating with ARS in an experimental mill program to see if they can be run viably and by women in groups.

5. Need for Language Training. ARS extension agents are not very effective. This is because most of them cannot speak the local dialect (Songhai). Moreover, most of them have received insufficient technical training and essentially no practical on-farm training. As a result, it is understandably difficult for them to gain the confidence of the farmers.

6. Need for Seeds. Finally, one of the most serious problems is lack of rice seed at planting time. The harvest is mid-October to mid-January. Farmers must pay taxes in early January, and clothes are most frequently bought during this period for festivals, etc. As a result, the farmers sell a high portion of their seed after harvest, and few farmers have enough seed for planting time. The Cooperation immediately recognized this problem, and has encouraged the cooperatives outside the project area to start seed granery programs (see Annex F); the program appears to be quite successful. ARS' solution of importing seed from Mopti is costly. The cooperatives in the project area have not started graneries because the Cooperation's policy (150% repayment, in kind) conflicts with that of ARS (115% repayment). The GRM does not want two programs with different policies operating in the same region. ARS needs to look for ways to cut its operating costs, and turning over the seed business to the cooperatives is clearly one way. But the cooperative movement is new, and many villages do not have them and probably will not have them in the near future either.

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B. Project Response to Problems

1. Research. The research problem will be addressed by supporting ARS' research station. A long-term (34 PM) rice production/research advisor, who has already been tentatively identified, will be financed under the project. He will assist ARS in continuing the work of the previously employed research technician and in developing an effective research program in both irrigated and floating rice, as well as in testing animal traction equipment. The project will finance the purchase of a tractor and accompanying land-leveling equipment to assist in leveling land at the research station. Most land leveling will occur between the first rains (usually early June) and the rise of the river (August). The GRM has agreed to the transfer of up to 12 pumps from the Action Blé project in Diré to support the new research station. As a result, a research program can be carried out in 1982. Five hectares of land will also be leveled in Gargouna for conducting research in farmers' fields there. IER will continue assisting in carrying out research at ARS' station, and ARS will appoint one agricultural engineer to head the research station work and another at Gargouna to supervise the test plots there. Regarding floating varieties of rice, the research will focus on yield potential and short growing cycle (to lessen damage from birds). As for irrigated varieties, the research will focus primarily on adaptability as well as a fertilizer response and cultural practices. ARS' previous technical advisor obtained a number of the latest IRRI varieties, which can be planted in 1982. Also, this research will focus on the feasibility of double cropping. Finally, the project will finance animal traction equipment to enable the technical advisor to conduct research at the same time in developing and adapting plows for the area. At the station a building will be constructed that will contain an office, store room, training room, and an outside repair area for equipment. The GRM will provide 15 pumps for the research station and the 5 hectare polder in Gargouna.

C. Pumps

The third problem--insufficient water and rain before the arrival of the river floods--will be addressed by expanding the pump rental program. However, before the program is expanded, certain improvements must be made in the existing program. To enable ARS to make these improvements and at the same time to collect more reliable data on the cost and impact of the program, a phased approach will be taken in implementing the expansion.

The first phase will last one year and will include the following actions: (a) putting the 16 existing pumps in working condition; (b) renting the existing pumps in the three sectors that USAID is supporting at a price sufficient to cover the estimated operating expense, repair and amortization of the pumps over a 5 year period; (c) maintaining detailed records on key operation and feasibility issues; and (d) establishing a special account into which all funds received for pump rental will be placed--to be used only for the purchase of spare parts and replacement pumps when needed.

Subject to the achievement of acceptable operational performance and economic results during this experimental phase, a second phase will be carried out under which the number of pumps will be expanded by up to twenty. The terms and conditions of rental will be agreed upon by ARS and USAID based on the information generated and experience gained during the first phase.

ARS will appoint a second person to the repair unit for on-the-job training. The Catholic Mission in Gao has a skilled repairman who fixes the Mission's pumps; the project will pay the Mission repairman for giving additional on-the-job training to both of ARS' repairmen. Repair work will be greatly facilitated by the reduction of the project area to 4 sectors; none of ARS' sector headquarters will be further than 15 miles from Gao. To ensure constant surveillance of pump maintenance, ARS will provide USAID/Mali with a monthly report on the working condition of all of its pumps. ARS will place 20 new pumps and 16 existing ones in the project sectors for renting to farmers. However, none of these can be used in the Cao sector until/unless ARS submits a report to USAID/Mali showing that the demand for pumps in the twon of Gao far exceeds the supply of those rented out by merchants. In addition, all of the 20 new pumps will be used for rental purposes only. The project will not finance a credit program for pumps because their cost is too high (over \$2,000). If there are farmers who wish to buy the pumps on a cash basis, ARS will assist them in making such purchases.

D. Water and Fish Control Gates

To attack the problem of fish damage and lack of water control, the project will finance the construction of approximately five water and fish control gates (ouvrages). These gates will protect an estimated 200-300 hectares of rice land each, or a total of 1,000-1,500 hectares in all. They will be constructed mainly in the flood plains of Forgho and Gao as well as, possibly, in those areas in the flood plains of Tacherane and Gargouma that are outside the insubmersible dikes. To encourage closer working relations with the cooperatives, ARS will not conduct such a program without first attempting to work entirely through the local cooperative(s). If USAID/Mali is satisfied this is impossible in a given community, then and only then may ARS conduct such a program on its own. As the Cooperation has done in the past, the cooperatives will group the people and do the manual labor, and ARS will provide the funds for purchasing cement and grills, as well as the engineer to design and supervise the work.

E. Mills

To give women more time for mat making and to relieve them of their most grueling work, the project will finance the purchase of 3 small mills and spare parts and the cement necessary for their installation to be used on an experimental basis in the villages of Tacherane, Gargouma and Forgho. ARS will enter into an agreement with the local cooperative whereby in return for the mill and cement, the cooperative will assist in the formation of a women's group (not the politically-oriented women's organization found in all of these villages), the members of which will also be members of the cooperative, and who will operate the mills. The milling price will be determined according to the cooperative's policy in all matters--that is, by the members themselves. The price will probably have to be identical to that charged by mill owner/operators in Gao, if it is to cover the cost of amortization. ARS will be paid back for the cost according to terms worked out between ARS and the cooperative. The cooperative will most likely have to hire a man to actually run the mill, while one woman will handle money collection, and another the weighing of the grain--exactly as done by operators in Gao. The Cooperation is very interested in trying the experiment as a way of working with women for profit-making activities. The total investment by the project is small (\$5,000/mill).

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Repair of the mills will be handled by the ARS repairmen, whom the cooperatives will pay to repair the machines as needed. No mills will be purchased without a significant number of spare parts, and none will be located more than 15 miles from Gao. Finally, when asked whether they would be willing to pay the same rate for milling as is paid in Gao, the villagers in all three sectors gave a very strong affirmative answer. Despite the probability that adequate demand may not be a problem, the mill operation is still considered experimental.

F. Training

As for the problem of poor training of agents and poor communication with villagers, the project will send ARS' two rice engineers working in research to IRRI for extension training or, if more appropriate, to the Bangladesh Rice Research Institute. They will also receive on-the-job training by the technical advisor. In addition, ARS will covenant to send no less than 4 agents a year to the research station to work for a year and, at the same time, to receive valuable on-the-job training. By the end of the project, 12 agents should be very knowledgeable in irrigated rice planting, animal traction, etc. Moreover, the project will finance training at the village level of all field agents unable to speak Songhai (with primes being paid after a year only to those who are able to function in Songhai). (Note: The results of the current USAID/Mali review of its primes policy may affect the amended Riz-Sorgho project.) The agents will be responsible for finding a teacher in the village. Finally, ARS will bring all agents and some villagers from time to time to the research stations for observation/training; a training room is being attached to the research station office for this purpose.

G. Seed Graneries

As for the last problem--lack of rice seed at planting time--the project includes a \$20,000 fund to be used, if necessary, for encouraging cooperatives in Gao, Tacherane, Forgho and Gargouna to set up graneries. An explanation of how this program works is included in Annex C. It is explained elsewhere why no such programs exist in the project area--policy differences between ARS and the Cooperation. As a covenant, the ARS will remove these policy differences and attempt to enter into an agreement with the Cooperation requesting the latter to encourage the cooperatives to set up programs there. Only if this fails, may the \$20,000 fund be used by ARS for implementing an identical village-level purchase-storage-sale (granery) program.

In addition, if the research program produces rice varieties that are superior and adaptable, this seed will be distributed by contracting with farmers to grow the seed as well as by growing it at the research station. No seed multiplication program run by ARS will be financed by the project because it is simply too difficult to operate. Few successful seed multiplication programs have been initiated in Africa.

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III. IMPLEMENTATION PLAN

A. ARS Staffing

Only those extension agents working in the project area will be involved in the project, and only they will be eligible for the primes. Staff working on the project will thus be reduced from the present level of 90. No more than 60 ARS people will, by covenant, be eligible for primes. The evaluation team thinks this would be an adequate size staff to implement this scaled-down project.

As part of the project (and by a covenant), ARS will assign one agricultural engineer to its research station and one to direct the 5 hectare research perimeter at Gargouma. ARS already has persons on its staff with such backgrounds. They will be sent to IRRI for training in rice production. In addition, ARS will appoint at least 4 of its agents to the research station each year; therefore, by the end of the project, at least 12 ARS agents (i.e., about half the field agents in the project area) will have received extensive on-the-job training in irrigated rice production and two will have received training in rice production. These agents are also needed to help operate the research station. Also, ARS will appoint another person on its staff to the repair unit; he will receive on-the-job training. Two repairmen will be sufficient to keep in repair ARS' water pumps and the experimental mills to be financed under the amended project. No additions to the headquarters staff are needed.

All other matters relating to staffing remain the same as under the project's first phase. The Director has been with the Action since late 1977, is well acquainted with all ARS' operations, and is well acquainted with AID procedures and requirements.

B. Implementation Plan

The implementation schedule is reasonably firm. The detailed activity schedule for the next year of the project is Section F herein.

Construction activities will be accomplished by ARS staff under the supervision of its construction engineer from the Office of Genie Rural. ARS has already constructed its headquarters building in a very satisfactory and economical manner (\$30,000) and is clearly capable of constructing a building at the research station. Regarding the water control gates, ARS, through its engineer, has already been involved in designing similar gates in a professional manner; thus ARS has proven itself entirely capable in this activity as well. As for the 5 hectare perimeter to be developed at Gargouma, Genie Rural has already given USAID/Mali a preliminary cost schedule. Genie Rural will supervise this construction as it did the ARS research station at Tacherane, which was built in a very satisfactory manner.

C. Other Donor/Organization Collaboration

1. Cooperative Movement/Euro-Action Accord. Collaboration between ARS and the Cooperative Movement has been constrained by the difference in extension methodology and the distribution of rice seed to farmers. The difference in extension methodology can be generalized as the difference between

the bottom-up, participatory approach followed by the Cooperative Movement vs. the top-down approach followed by ARS. This difference in approach is consistent with the Cooperative Movement's efforts to have farmers identify problems and together look for solutions vs. the assumption on the part of ARS that it already come up with solutions to increasing agricultural production and that the farmers should be obliged to follow the advice of its agents. Prior to the evaluation, the relations between ARS and the Cooperative Movement were such that they were virtually unable to work in the same villages. Since the evaluation, some improvement in the relationship has occurred. The most notable example of this improvement has been the earlier described successful construction of flood gates with fish screens in one village with both agencies playing a key role. While each agency is capable of implementing a flood gate construction program on its own, based in part on this successful experience, both agencies have expressed a willingness to continue collaborating on water gate construction. Under the amended project, ARS will on a case by case basis reach agreement with the Cooperative Movement under which the latter would take responsibility for organizing the villagers while ARS would provide financing as well as the design/supervision support required using the Genie Rural engineer assigned to ARS. At the same time, if the Cooperative Movement is not active in a village which needs and is ready to construct flood gates, ARS is fully capable of organizing and implementing a flood gate construction program. The methodological gap between ARS and the Cooperative Movement will be narrowed when the ARS agents are given extension training which will emphasize collaborative extension techniques. Further, progress should be possible as ARS focuses more heavily on research and extension.

The problems related to provision of rice seeds to farmers described earlier appear to have been resolved with the agreement by ARS to change its repayment policy to coincide that being successfully implemented by the Cooperative Movement; i.e., for every 100 kilo bag of seeds lent by ARS to the farmers, they will pay back 150 kilos. Further, ARS will in the future encourage cooperatives which have not already done so to establish seed graneries. ARS will aid them in separating varieties and treating them with fungicide and insecticide.

The Cooperative Movement, Euro-Action-Accord technicians, and ARS agree that the cooperatives are the logical organization to run the mills. The Cooperation has helped cooperatives to start women's groups outside the project area (e.g. Bourem) for craft-making. Similar groups will be formed to operate the mills. The Cooperation says that their experience elsewhere demonstrates that such women's groups are fully capable of handling this type of enterprise on a profitable basis.

2. Institute d'Economic Rural (IER). The GRM's research institution, IER, and ARS have already been collaborating at the ARS research station. IER has stationed an agronomist there to work with the ARS agronomist in carrying out jointly designed test plots. The project will help finance IER's work at the station so as to ensure this joint effort.

3. Caisse Centrale de Cooperation Economique (CCCE). As stated previously, the CCCE will most likely finance irrigated rice schemes in Tacherane and Forgho to test their viability and the feasibility of cooperatives operating such schemes. The engineering plans are being finalized by Genie Rural. While the CCCE will be working through the cooperatives in these two villages to

implement the program, their technicians have expressed great interest in using the ARS extension agents there to help train the farmers in irrigated rice production. ARS' participation in this respect is part of the amended project.

D. Evaluation Plan

A mid-term in-house evaluation by USAID and the GRM is scheduled for one year after the signing of the amended Grant Agreement. A full end-of-project evaluation in 1985 is scheduled and \$40,000 has been put in the project budget for TDY assistance and participation by IER, including follow-up data collection prior to the arrival of the expatriate members of the evaluation team. The 1985 evaluation team will be composed of members similar to those on the recent evaluation, including an AID evaluation officer, a sociologist/anthropologist, an economist, a rice agronomist, and an IER research specialist and agronomist. These evaluations will focus primarily on cereal production increases/crop loss reductions and resulting economic benefits due to project interventions, results of the research program, and the viability of the experimental mills and cooperative approach. ARS, with assistance from the IER agronomist at the station and the rice research advisor, will be responsible for collecting production data in the area similar to that done in 1978/79 by Walker, and in 1979/80 by IER-- for comparison purposes.

E. Disbursement/Procurement Procedures

In general, disbursement procedures will not be changed under the amended project. ARS' books received a limited financial audit in August, 1981 by USAID's financial analyst, and all monies appeared to be accounted for. With respect to the technical assistance contract, USAID will do the contracting through a personal services contract almost identical to that under which the previous rice research advisor was employed for the project. Procurement of all commodities listed in the financial breakdown except plows, fungicides and insecticides will be carried out under a procurement services contract with a U.S. procurement agent by USAID/Mali with PIO/Cs. ARS will procure the remaining commodities and be reimbursed by USAID/Mali using the standard 1034 forms.

ARS will no longer qualify for credit from the Banque Centrale du Mali because it is a project and not a private enterprise. Therefore, in some instances ARS will have to establish a revolving financial fund, initially, from which to purchase fungicides, plows, etc. This fund will not be large because the value of commodities needed under the amended project which ARS has heretofore purchased with credit from the bank or SCAER (plows, fertilizers, etc.) is small.

F. Implementation Schedule

<u>Event</u>	<u>Date</u>
- Authorization	April 1982
- ARS revised 1982 budget and pump replacement and spare parts list submitted for existing pumps	
- Project Grant Agreement signed	May

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<u>Event</u>	<u>Date</u>
- Genie Rural requested to draft engineering plans for 5 ha Gargouna test plot	
- Major commodities and spare parts ordered (tractor, mills, plows, generator, animal traction equipment)	
- All existing ARS pumps repaired	
- Contract signed for rice agronomist	
- Arrival in Mali of rice agronomist	
- Pump rental fee analysis submitted by ARS to USAID/Mali	
- Second ARS staff person assigned to pump repair unit and training begins	
- ARS agents begin Songhai lessons	
- ARS agricultural engineers assigned to research station	
- GRM provides 12 Action Blé type pumps to project for station	
- Minimum 4 ARS agents assigned for yr-long training at research station	June
- IER and ARS reach agreement on test designs for research station	
- Pumps (GRM provided) installed at research station	
- Plows and animal tractor equipment (purchased locally) arrive Bamako/Gao	
- Completion of 5 ha polder design by Genie Rural	
- Revolving fund set up at bank for ag products sales	
- Sale of fungicides, insecticides, plows begins	
- New conditions for pump rental explained by ARS to farmers	
- Farmers begin paddy rice nurseries	
- Construction/land leveling begins at Gargouna 5 ha test plot on farmers' fields	
- Commencement of pump rental program at Tacherane, Gargouna, Forgho	June
- Additional land leveling begun at research station	
- Nurseries begun at research station and Gargouna plot	
- Genie Rural completes work at Gargouna 5 ha test plot, including land leveling	July
- Planting of floating rice varieties begins at research station and Gargouna test plot	
- ARS submits operating budget for next 6 month period	
- Transplanting of rice on research station and Gargouna plot begins	
- Transplanting ends	August
- ARS agents visit research station for short-term training	September
- Cooperative members/farmers visit research station	October
- Mills arrive	
- Cooperatives/villagers approached with idea of building fish and water control gates, and idea of operating mills	
- Cooperatives prepare house for operating mills and form women's group to direct	November
- Two ARS agronomists sent for training at IRRI	
- Mills installed and operation begun	
- Harvest of rice begins at research station and Gargouna plot	
- Cooperatives discuss water control gates location, with members and ARS agents	December
- End of rice harvest	

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<u>Event</u>	<u>Date</u>
- ARS submits budget for 1983	
- Sorghum trials/plots designed and finalized at research station	
- Construction begins of office/supply room/training room building at research station	
- Sorghum trials installed at research station	January 1983
- ARS' 1982 campaign report submitted	February
- Report on results of pump rental program submitted	
- Rice agronomist and IER submit reports of results at result station and Gargouna test plot	
- Primes cut-off for those agents unable to speak Songhai	March
- Procurement of 20 new pumps/spare parts initiated	
- Additional four ARS agents selected for training at research station	
- The cooperatives, ARS and villagers commence water control gate construction program	
- Tractor, land leveling attachments, and spare parts arrive for use at research station	April
- AID in-house evaluation of project undertaken	
- 20 new pumps plus spare parts arrive	May

G. Covenants for the Grant Agreement Amendment

1. To ensure that the water pumps to be purchased under the project will be properly repaired and maintained in good condition, the Grantee (GRM) agrees to carry out a one-year pilot program using the 16 existing pumps. As part of that pilot program, the GRM further agrees to (a) appoint a second person from within the Action's staff to the Action's pump repair unit, (b) limit the use/rental of all 16 pumps to the three sectors closest to Gao (Gargouna, Tacherane and Forgho) unless otherwise agreed to in writing by USAID/Mali, (c) in consultation with the pump supplier, draft replacement and a spare parts list satisfactory to USAID and purchase such spare parts, and (d) maintain detailed records satisfactory to USAID on the costs and returns generated by the pumps under the pilot program.

2. To ensure improvement in the quality of the Action's work by permitting the Action to concentrate its work more heavily in the four sectors closest to Gao (Tacherane, Gargouna, Gao and Forgho), the Grantee agrees to use/place no commodities to be purchased by the project outside these four sectors, with the exception of office supplies, plows, AID approved fungicides and insecticides, except as agreed to in writing by USAID/Mali.

3. In order to reduce the Action's operating expenses, the Grantee agrees to (a) use no project funds to import seed from outside the Gao area except for research purposes, (b) use no project funds to pay salaries except for technical assistance, manual labor, and temporary staff assistance, and (c) use no project funds to give primes to extension agents outside the four sectors mentioned above, or to allow more than 60 people in ARS to be eligible for primes.

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4. In order to motivate the Action's extension agents to learn the native language of Gao, Songhai, the Grantee agrees to make available project funds to the Action's agents for the purpose of learning Songhai and to pay no primes after April 1, 1983, to those extension agents who are not functional in Songhai, as defined by agreement between the Action and USAID/Mali.

5. To ensure that the Action's staff benefits to the maximum extent from the research work financed by the project, the Grantee agrees to (a) appoint from within the Action's staff agricultural engineers to direct the Action's research work at Tacherane and Gargouna, (b) appoint a minimum of four Action agents per year during the next three years of the project to the Action's research station at Tacherane, each agent receiving one year's on-the-job training, and (c) assign those agents thereafter to the project area for the life of the project in positions appropriate to their training.

6. To ensure the continued provision of agricultural supplies/products and water pumps after the end of the project, the Grantee agrees to (a) within three months of the signing of the Grant Agreement establish a revolving fund into which all proceeds will be placed from the sale of such supplies/products, such as fungicides, plows, etc., and a second similar revolving fund specifically for water pumps, which the Action may use to purchase replacement pumps and spare parts, and (b) prior to the purchase of any water pumps under the project, and based on the actual experience during the first year with the existing 16 pumps, provide a report in form and substance satisfactory to USAID/Mali showing that the rental fee will be sufficient to cover all operating costs, including amortization of the pump and projected spare parts requirements over a four-year period.

7. As a contribution to the project by the Grantee, the Grantee agrees to provide, or identify in writing and make available to, the project's research unit within one month following the signing of this agreement, 15 operational water pumps of the type used by the Action Blé Project, including the full assortment of spare parts accompanying each pump.

8. To encourage the cooperatives in the project area to start their own village-level granary programs and thereby help reduce the Action's seed provision program and reduce operating costs, the Grantee covenants that the Action will adopt a policy of recovering 150 per cent of the seed given on credit to farmers in the project area, thus harmonizing the policies of the two organizations.

9. In order to ensure that insubmersible dikes constructed under the first phase of project funding at Tacherane and Gargouna are properly maintained, the Grantee covenants to develop and implement a comprehensive plan satisfactory to USAID for dike repair and maintenance.

IV. Economic Analysis

A. Introduction

The assumptions of economic analysis need to be cast in the background of the farming systems practiced in the Gao area. Given that the area receives about 200 mm of rainfall in an average year, no cereals are grown under strictly rainfed conditions. The main cereals cultivated are rice (floating variety) and sorghum. Sorghum is planted as the flood waters recede, living on residual moisture until the rains begin. It is most often transplanted from seed beds and sometimes irrigated by land if necessary until rain occurs.^{1/} The sorghum is harvested before the flood returns; it is planted on higher, well-drained areas due to susceptibility to fungus. Thus rice planting can begin in the lower areas before sorghum harvest.

Floating rice is planted before the river begins rising from the season's rains. The river level depends mainly upon rainfall in Guinea, near its headwaters over a thousand miles from Gao. The rainy season in Gao corresponds roughly to the rainy season in Guinea with the peak occurring July through September, but the river level in Gao does not peak until November-December. As the rains begin in Gao, rice is planted, at first nearest the water's edge. The variety planted is floating rice which requires about 40 days after germination to reach a stage of elongation. During elongation the plant can grow fast enough to keep the apical bud above water. If the flood begins before elongation occurs, the plant cannot keep itself above water and will drown. The rice cannot be planted before the rains begin, but must reach elongation before the flood begins. The time constraint can be controlled somewhat by transplanting rice seedlings from beds. About 20 per cent of all rice grown is transplanted.

The rice is planted after the first good rain and, until flooding occurs, must receive additional water every 10 to 15 days afterward depending upon variety, soil water retention capability, evapo-transpiration rates, and the distribution, over time and space, of rainfall. The timing and level of the flood varies considerably from year to year. Rice is also subject to damage from fish and birds. With the exception of varietal selection, limited irrigation and transplanting, these variables are subject to little control by the farmers.

As currently practiced, cereal farming in the Gao area is more of an art than a science. Success depends mainly upon being able to intuitively second-guess the forces of nature. A few farmers have attained an ability to cultivate crops under these conditions and do well; most others practice a type of farming based on minimum input with maximum risk of failure. This is illustrated in a 1978 study of 24 randomly selected farmers from the area.^{2/} For the crop

1/ Agricultural Survey of the Action Riz-Sorgho Area, October-January 1978-79. Walker, C.F.

2/ An Analysis of Income and Expenditures of Farm Families in the ARS Zone, Putman, D.B. 1978.

year 1976/77, all but two complained of near total failure and having to supplement their diet heavily with exotic noncereals. One of the successful farmers cultivated about 11 hectares with 9 active members of his immediate family and stated that he only employed outside labor during land preparation and planting. This is contrary to the usual assumption that hired labor is most often required during weeding and harvesting. Planting is normally thought to be the least labor intensive activity. In this farmer's case, it could be that land preparation and planting occur simultaneously. However, the use of extra labor at this time indicates that the farmers place more emphasis on heavy investment early in the season and likely use intensive cultivation technologies.

For most of the farmers in the zone, cereal cultivation is akin to high risk, low stakes gambling. They practice extensive methods under a wide variety of physical conditions knowing that at least some plots will pay off sufficiently to cover input costs for all plots. ARS data seem to substantiate this observation (note Tables 1 and 2). Rice yields vary drastically from an average of 650 kg/ha to 1,816 kg/ha over a five-year period, for a five-year average of 1,154 kg/ha. Table 1 indicates that 1979/80 was above average for the five-year period. However, Table 2 shows that 1979/80 was substantially below average in terms of the land harvested versus planted and total production.

Selected ARS statistics from the 1979/80 crop year listed below further illustrate the high risk assumed by area farmers:

- 34% of land planted to rice was harvested
- 63% of land planted to sorghum was harvested
- 24% of farmers had no harvest of either crop
- 49% harvested on part of their fields
- 27% harvested on all fields
- 70% of low-lying areas had some harvest
- 58% of total production was from 23% production units.

TABLE 1

RICE PRODUCTION DATA FOR
THREE SECTORS OF PROJECT ARFA

	<u>Rice Yield (kg/ha)</u>
1977/78	650
1978/79	1,054
1979/80	1,350
1980/81	1,816
1981/82	900 (preliminary)

Average: 1,154 (for purposes of analysis yields were considered on average 1,200 kg/ha)

Source: ARS documents

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Table 2: PRODUCTION BY AREA

	<u>Gargouna</u>	<u>Tacharane</u>	<u>Forgho</u>	<u>Total</u>
<u>1978/79</u>				
Area sown (ha)	1,009	663	1,415	3,087
Area harvested (ha)	937	649	529	2,115
Yield (kg/ha)	1,281	645	1,236	1,054 (av.)
Production (tons)	1,201	419	654	2,274
Transplantation (ha)	42	60	149	251

69% of area sown was harvested. 8% transplanted,

1979/80

Area sown (ha)	1,030	713	1,644	3,387
Area harvested (ha)	247	297	32	576
Yield (kg/ha)	1,392	1,946	714	1,350 (av.)
Production (tons)	344	579	22	945
Transplantation	18	100	133	229

17% of area sown harvested.

6% of area transplanted,

1980/81

Area sown (ha)	916	983	491	2,390
Area harvested (ha)	846	664	246	1,756
Yield (kg/ha)	1,704	2,219	1,526	1,816 (av)
Production (tons)	1,442	1,474	374	3,290

73% of area sown was harvested.

Figures are not yet available for 1981-82 campaign. Preliminary information suggests that up to 35% of area sown had no harvest and that yields will average somewhere around 900 kg/ha. *JM*
 Source: AID Evaluation of ARS. April 1981.

B. Interventions

The ARS will directly assist farmers reduce the risk of cereal cultivation with respect to moisture, water level, and fish control. The project will provide 36 diesel-driven pumps for rental to farmers when rainfall is insufficient. Pumping is currently practiced on a limited basis. The ARS will assist farmers, where applicable, to construct gates at points where the flood waters enter their cropland for control of fish and water level. The ARS has installed a successful floodgate; the project will provide funding for an additional five. The project will continue funding the research station. Although it is doubtful any new techniques will be developed in time for extension to farmers during this three-year extension, the station is necessary nevertheless for achieving project objectives by testing and demonstrating practical techniques for utilizing pump irrigation. Further, we fully expect that important results will be achieved within five years under IER management.

C. Financial Analysis of Interventions

1. Pumps

Each year rice production on some plots is drastically reduced or lost due to stress from lack of moisture between the time of planting and arrival of flood waters. Due to cost of pumping versus potential return, we have assumed that land considered to be at high risk of moisture stress or insufficient flood due to distance from the river will not be selected for irrigation. The land selected will require no more than two waterings in a given crop year. Pumping will supplement rainfall. Since the rice needs water every 10 to 15 days, the farmers will begin watering on the eighth day after no rain and continue to the fifteenth day. The pumps will operate 24 hours a day during this period. Thus each pump will be in use a total of 336 hours a year (7 days x 2 waterings x 24 hours).

These assumptions are considered to be averages. Some rice varieties are more tolerant to water stress than others. Some will need water by day eight after a rain and others can survive until day fifteen. There also will be times when rain occurs immediately after irrigating, thus diminishing the increased yield due to pumping to less than the assumed 600 kilograms (see Table 4). Yet there will be times when the watering will be critical to avoid total crop loss, and the marginal production attributable to pumping will be significantly greater than 600 kilograms per hectare.

The pumps will run one hour out of two; the remaining time will be used for positioning the pump, etc. It requires nine hours actual pumping to water one hectare or eighteen hours total use. Each pump will service 9.4 hectares per year.

Pumping cost data are as follows:

Original Cost (1 pump)	\$2,200
Salvage Value (25% of cost)	550
Amortization	1,650
Annual Depreciation (5 yr. life)	330
Maintenance (10% cost/year)	220
Annual Overhead	550
Fuel Cost (\$1.50/hour x 168 hours)	252
Total Cost Per Year	802
Cost per hectare (802 ÷ 9.4)	85.32
	or 42,926 FM

Table 3 shows average inputs per hectare under traditional conditions. Table 4 compares irrigation to traditional methods and shows the farmer increasing yields by 50 per cent (600 kilograms) and making a net return of 48,574 FM on an investment of 44,426 FM (pump cost plus labor). The anticipated net return to farmers is considered sufficient to entice him to use pumping.

2. Water and Fish Control Gates

It is estimated by ARS technicians that each gate can serve 300 hectares of land and increase average yields by 20 per cent. These estimates are considered realistic in view of the extensive damage done by fish and untimely water level changes. Each gate is expected to cost 6,050,000 FM (\$11,000) and is constructed in such a fashion that maintenance costs are negligible. The above assumption implies that each gate would generate almost twice its cost in increased value of production each year. While this increase may be technically feasible, it is not considered organizationally feasible.

Land in the Gao area is seldom uniform among plots contiguously cultivated in rice for any given tract. Each plot will have different requirements in terms of timing and amount of water. There inevitably will be disputes among farmers about water control within the area served by a gate. To minimize these disputes the ARS must be given final authority by all farmers involved in water regulation before project-funded gates are constructed. Given that the average holding is less than two hectares and the ability of farmers to take group decisions is inversely proportional to the number of farmers involved, it will be assumed that each gate will serve at most 150 hectares. Yields are assumed to increase 20 per cent. When functioning properly, each gate will increase production by 240 kilograms per hectare for a total of 36 tons per crop. The value of increased production to farmers will be 5.58 million FM valued at 155 FM per kilogram.

Table 3: COST OF PRODUCTION PER HECTARE FOR
RICE PRODUCTION IN GAO REGION

<u>Inputs</u>	<u>Cost</u>	<u>Quantity</u>
Seeds	10,000	50 kg, 200 MF/kg
Equipment	1,000	Hoes, other implements
Fungicide ⁽¹⁾	<u>650</u>	1 sachet 65 MF, 10 sachets for 100 kg of seed
	11,650	
 <u>Labor</u> ⁽²⁾		
Activity:		<u>No. days per hectare</u>
Soil preparation	7,500	10 ⁽³⁾
Seeding	500	1
Weeding	15,000	20 ⁽⁴⁾
Harvesting	9,000	12 ⁽⁵⁾
Hulling	2,500	5
Winnowing	1,000	2
Dike Maintenance	2,500	5
Transport	<u>500</u>	<u>1</u>
	38,500	56

Total cost/ha: 50,150

Average yield/ha: 1,200 kg.

- (1) Fungicides are provided at a subsidized price, but the true cost of them was not known at the time of this writing. 65 F per sachet is the price ARS charges. A minority of farmers uses fungicide.
- (2) Hired labor is paid approximately 1,000 MF/day in ARS area. Farmers' own labor is shadow priced at half of this, 500 MF/day. For the activities that require over 10 days, it is assumed that half of the labor required is hired and paid accordingly.
- (3) 5 days hired labor at 1,000MF, 5 days at 500MF; 7,500MF.
- (4) 10 days hired labor at 1,000MF, 10 days at 500MF; 15,000MF.
- (5) 6 days hired labor at 1,000MF, 6 days at 500MF; 9,000MF.

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**TABLE 4: COMPARATIVE FARMER RETURNS
WITH AND WITHOUT PUMPS
(MALI FRANCS)**

<u>Inputs</u>	<u>Without Pump</u>	<u>With Pump</u>
Seeds	10,000	10,000
Equipment	1,000	1,000
Fungicide	650	650
Labor	38,500	40,000 ^{1/}
Pumping		42,926
Total Cost	50,150	94,576
 <u>Production</u>		
Rice (kilograms)	1,200	1,800 ^{2/}
 <u>Returns</u>		
Value/kilogram	155 ^{3/}	155
Total Value	186,000	279,000
Cost	50,150	94,576
Net Returns	135,850	184,424
Net Difference to Farmers		48,574

1/ Labor for irrigating is 1.5 person-days per watering, 2 waterings per crop at 500 MF/day.

2/ Walker's survey (ibid) showed yields approaching 2,000 kg/ha, which is considered to be about the maximum for floating rice in field conditions. A reasonable estimate is thought to be 1,800 kg/ha.

3/ Free market price measured at lowest point of year, just after harvest.

3. Seed Program

The ARS is involved in providing seed rice to farmers on credit, reimbursable at the end of the harvest at 115 per cent of the amount loaned. The amount of return barely covers losses and nonpayments. Many of the area farmers have come to depend upon this source of seed and no longer attempt to store their own. This activity must continue during the period of USAID funding to ensure the success of other components. However, under the project extension, ARS will increase the cost of borrowing seed to 150 per cent. Farmers will be encouraged to form cooperatives to provide a rice granary program. ARS will gradually discontinue the seed program on a regular basis.

4. Seed Treatment

The ARS annually places about 5,000 packets of fungicide for seed treatment. Each packet is sufficient to treat 10 kilograms of seed. Given that the seeding rate is 100 kilograms per hectare, the fungicide serves about 500 hectares. Seed treatment is used for planting areas where seeds are highly susceptible to fungus attack, usually due to poor drainage. Although no empirical information exists on the effect of seed treatment on yields for these areas, it is conservatively assumed that their average yields are increased by 20 per cent (240 kilograms per hectare). Cost of the fungicide packet is minimal at 150 FM each (about \$0.16).

D. Macro (Social Benefit/Cost) Analysis

Assumptions

1. ARS has 16 pumps on hand and all will be operational in year one. Half of these will be replaced in year four and the remainder in year five. Ten new pumps will be added in year two and ten more in year three. Replacement cost of pumps is reduced 25 per cent to account for salvage value. Cost of pumps in project budget includes a spare parts package; this amount is taken out of investment and reflected in pump maintenance (nonproject costs). Cost of pumps is shifted from project budget in year one to year two and three corresponding to operational schedule.
2. Investment costs of pumps and gates include 10 per cent contingency above project budget. Ten per cent was used in analysis because cost of these items is more variable than others (salaries, etc.), rather than the 7.5 per cent used in the Project Paper.
3. Recurring costs of pumps include fuel and maintenance and are assumed constant from year to year. Recurring costs of pumps are negligible; however, fish screens must be replaced every ten years at a cost of \$2,000 each.
4. Two gates will be fully operational in year two, and five in year three.

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5. The relationship between prices of inputs and outputs is assumed to remain constant throughout the period of analysis. Sensitivity analysis tests change in this relationship.

6. Production is valued at the import price, that is, the current cost of the private market (external to the GAO region) supplying Gao during the period of weakest supply, July through October. On average this price is \$900 per ton of milled rice.

7. On-farm production was reduced 30 per cent to account for milling and 10 per cent to account for storage costs and losses.

8. Nonproject costs include only the costs of those items necessary for the increased production that are imported from outside the region. Those include fuel/maintenance of the pumps and fungicide. All remaining costs, including milling by hand, are shadow priced at zero under the premise that these factors of production are seriously underemployed given current conditions in Gao.

9. Benefits and costs are discounted to present value using a 10 per cent factor.

Results

The analysis results given in Table 6 show that when the future stream of benefits and costs are discounted at 10 per cent, the ratio of benefits to costs in terms of present value is 0.972. The internal rate of return (IRR) of the project is slightly less than 9 per cent. There are two major factors contributing to the low IRR. One is the continued high cost of the ARS relative to expected output. The second factor relates to the opportunity costs of grain production in Gao versus grain imports when those imports are provided through GRM channels. The analysis valued output at the cost of supplying this output by the private sector. If a grain supply shortage occurs in the area, the GRM feels compelled to supply at least a portion of the deficit. The cost to the GRM is considerably higher than the private sector. The analysis also omits, due mainly to lack of base for projection, any reference to the secondary economic activity generated by providing locally rather than importing. This is an important factor given the extensive underemployment in the Gao region.

Sensitivity Analysis

With a modest internal rate of return, the outcome is obviously sensitive to any significant variation in assumptions. If costs escalate by 10 per cent overall, or if market prices drop, or yield increases are overestimated by 10 per cent, the resulting benefit/cost ratio is 0.876 and the IRR drops to about 6 per cent.

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TABLE 5

FINANCIAL SCHEDULE OF INTERVENTIONS

Y E A R S

Item	Y E A R S		
	1	2	3
<u>Cost^{1/}</u>			
Pumps			
Investment	35.2 ^{2/}	44.0	0
Recurring	3.8	8.5	13.2
Gates			
Investment	11.0	22.0	22.0
Recurring ^{3/}	-	-	-
Fungicide			
Recurring	1.0	1.0	1.0
<u>Returns</u>			
<u>Production^{4/}</u>			
Pumps	90.0	146.4	202.8
Gates	-	72.0	180.0
Seed Treatment	<u>120.0</u>	<u>120.0</u>	<u>120.0</u>
Total	210.0	338.4	502.8
<u>Value^{5/}</u>			
Farm gate	58.8	94.8	140.8
Export/Import	113.4	182.7	271.5

^{1/}\$ U.S. thousands, includes 10% contingency.

^{2/}16 pumps currently on-hand in ARS. Will be replaced in year four and five.

^{3/}Negligible, however screens are replaced after 10 years at \$2,000 each.

^{4/}Metric tons.

^{5/}Farm gate value is \$280 per ton at harvest. Export/import value is \$900/ton at time of weakest supply and reflects costs of replenishment outside region. Total quantities reduced 70% for milling and 10% for storage and losses.

TABLE 6

BENEFIT/COST ANALYSIS
ARS EXTENSION

	Y E A R S																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
<u>Cost</u> ^{1/}																				
Project																				
Investment	508.0	257.0	261.0	13.2	13.2	16.5	16.5	-	13.2	13.2	20.5	22.5	-	13.2	13.2	16.5	16.5	-	13.2	13.2
Recurring - Project	126.0	126.0	126.0	126.0	126.0	126.0	126.0	126.0	126.0	126.0	126.0	126.0	126.0	126.0	126.0	126.0	126.0	126.0	126.0	126.0
- Nonproject	8.6	13.3	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0
Total Cost	642.8	396.3	404.0	156.2	156.2	159.5	159.5	143.0	156.2	156.2	163.5	165.5	143.0	156.2	156.2	159.5	159.5	143.0	156.2	156.2
Discounted (10%)	642.8	360.2	333.7	117.3	106.7	99.1	90.0	73.4	72.9	66.2	63.1	57.9	45.6	45.3	41.1	38.1	34.8	28.3	28.1	25.6
Present Value (all years)	2,370.2																			
<u>Benefits</u> ^{2/}																				
Pumps	48.6	79.0	109.5																	
Gates	-	38.9	97.2																	
Seed Treatment	64.8	64.8	64.8																	
Total Benefits	113.4	182.7	271.5	271.5	271.5	271.5	271.5	271.5	271.5	271.5	271.5	271.5	271.5	271.5	271.5	271.5	271.5	271.5	271.5	271.5
Discounted (10%)	113.4	166.1	224.3	203.9	185.4	168.6	153.1	139.3	126.8	115.1	104.8	95.0	86.6	78.7	71.4	64.9	59.2	53.8	48.9	44.5
Present Value (all years)	2,303.8																			
<u>Discount Factor</u>	1	.909	.826	.751	.683	.621	.564	.513	.467	.424	.386	.350	.319	.290	.263	.239	.218	.198	.180	.164
<u>Benefit/Cost Ratio</u>	0.972																			

^{1/} \$U.S. Thousands^{2/} See Table Five for Details

Note: Investment for first three years was taken from USAID budgets with following modifications: (a) Inflation factor removed, (b) Cost of pumps (\$4,000) split into years two and three; (c) Cost of pump

spare parts (\$16,000) included in nonproject recurring cost. (d) Revolving fund for fungicides/insecticides removed from investment. Fund will continue to exist.

ACTION RIZ-SORGHO AMENDMENT WAIVERS

The following waivers are requested, as justified below:

A- A source/origin and proprietary procurement waiver is requested to purchase one Land-Rover and 20 Bernard water pumps, with parts, from England and France, respectively. (AID Geographic Code 899).

- one Land-Rover: \$20,000
- 20 (twenty) Bernard pumps: \$60,000

1) Land-Rover: The Project phase I approved in September 1976 authorized the procurement of eight Land-Rovers which were purchased during FY's 1978 and 1979. These Land-Rovers are the only four wheel drive vehicles of the project motor pool. Mechanics are very familiar with them and spare parts are reasonably available in the Gao area. U.S. made four wheel drive vehicles are not available in Mali. International Harvester no longer makes Scouts. Besides, all the I.H. Scouts purchased for other projects from 1978 to 1980 performed very poorly. AMC has opened a dealership in Bamako and is slowly developing a market in the Bamako area. It will be a long time before the Gao area can be included. The aftersale services are practically not existent.

2) Bernard water pumps: The project also has available fifteen Bernard water pumps used by farmers throughout Phase I implementation. Mechanics as well as farmers are very familiar with these pumps and can find parts easily. The purchase of additional Bernard pumps will satisfy farmers' needs to standardize on this brand. A change of specifications will inevitably impede project implementation because problems such as maintenance, training, handling of parts, etc. will occur.

The Land-Rover and the Bernard pumps are essential to the successful implementation of the project and no other non-AID funds are available to purchase them.

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ANNEX B

Supplemental Budget Request

	<u>PY 4</u> <u>1982</u>	<u>PY 5</u> <u>1983</u>	<u>PY 6</u> <u>1984</u>	<u>Total</u>
1. <u>Technical Assistance</u>				
a. Rice Agronomist	75,000	75,000	75,000	225,000
2. <u>Training</u>				
a. IRRI (2 agents)	40,000	-	-	40,000
b. Farmers (per diems)	-	500	1,000	1,500
c. ARS Agents (Songhai)	<u>4,000</u>	<u>2,000</u>	<u>-</u>	<u>6,000</u>
Subtotal	44,000	2,500	1,000	47,500
3. <u>Construction</u>				
a. Research Station (warehouse/ office - training room/dorm building)	15,000	-	-	15,000
b. Water Control - gates/screens	10,000	20,000	20,000	50,000
c. Experimental Research Plot at Gargouna (5 ha)	60,000	-	-	60,000
d. Upgrade garage	<u>6,000</u>	<u>-</u>	<u>-</u>	<u>6,000</u>
Subtotal	91,000	20,000	20,000	131,000
4. <u>Commodities</u>				
a. 20 pumps (6 hp), hoses, spare parts	60,000	-	-	60,000
b. 3 mills/installation/ spare parts	15,000	-	-	15,000
c. 60 plows (revolving fund)	3,000	3,000	3,000	9,000
d. Fungicides/insecticides (revolving fund)	3,000	-	-	3,000
e. Research station tractor and spare parts	40,000	-	-	40,000
f. Animal traction equipment for research station	6,000	-	-	6,000
g. Vehicle-Land Rover	20,000	-	-	20,000
h. Seed testing equipment	3,000	1,000	1,000	5,000
i. Rice seed (revolving fund)	20,000	-	-	20,000
j. Other seed (revolving fund)	5,000	-	-	5,000
k. Generator (25 kva)	10,000	-	-	10,000
l. Fuel tank pump	<u>16,000</u>	<u>-</u>	<u>-</u>	<u>16,000</u>
Subtotal	201,000	4,000	4,000	209,000
5. <u>Operating Expenses/Maintenance</u>				
a. Gasoline/diesel fuel	27,000	27,000	27,000	81,000
b. Research Station/IER	21,000	13,000	13,000	47,000

ANNEX B (cont'd.)

	<u>PY 4</u> <u>1982</u>	<u>PY 5</u> <u>1983</u>	<u>PY 6</u> <u>1984</u>	<u>Total</u>
c. Vehicle Maintenance	20,000	25,000	30,000	75,000
d. Primes	20,000	20,000	20,000	60,000
e. Travel/per diem	4,000	4,000	4,000	12,000
f. Office Supplies	10,000	10,000	10,000	30,000
g. Construction/Repair/Main- tenance - Buildings and Equipment	<u>18,000</u>	<u>18,000</u>	<u>18,000</u>	<u>54,000</u>
Subtotal	120,000	117,000	122,000	359,000
Subtotals Combined	531,000	218,500	222,000	971,500
6. <u>Contingencies</u> (7.5%)	39,825	16,388	16,650	72,863
7. <u>Inflation</u> (10% compounded)	<u>-</u>	<u>21,900</u>	<u>24,100</u>	<u>46,000</u>
GRAND TOTAL	570,825	256,788	262,750	1,090,363

GRM COUNTERPART FINANCING

	<u>PY 4</u> <u>1982</u>	<u>PY 5</u> <u>1983</u>	<u>PY 6</u> <u>1984</u>	<u>Total</u>
1. <u>Construction</u>				
a. Land (5 ha)	3,000	-	-	3,000
2. <u>Operating Expenses/Maintenance</u>				
a. Salaries	125,000	125,000	125,000	375,000
b. Vehicle Insurance	1,000	1,000	1,000	3,000
3. <u>Inflation</u> (10% Compounded)	<u>-</u>	<u>12,500</u>	<u>26,000</u>	<u>38,500</u>
GRAND TOTAL	129,000	138,500	152,000	419,500

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ANNEX C

THE COOPERATIVE MOVEMENT IN THE SEVENTH REGION OF MALI

The cooperative movement in the Sixth and Seventh Regions of Mali had its beginning in 1975. The movement is directed by the Direction Nationale de la Cooperation ("Cooperation") which has offices in Bamako and a regional office in Gao. It is being financed by Euro-Action-Accord. There is minimal intervention/supervision by the GRM. The foremost problem which the cooperative movement is trying to attack in the Gao area is the high price of consumables, particularly rice, as well as sugar, salt, etc. For one reason or another, farmers in the area are in the habit of selling a large portion of their harvests in December-January (to pay taxes and buy clothing, above all), which forces them to buy grain from merchants at twice and three times the price six months later. A second major problem is the loss of livestock in the area due to the 1973-74 drought; the cooperatives are helping herders/farmers build up their stocks with credit. There are a number of other problems which the cooperative movement is also addressing - deforestation, disease, illiteracy, lack of rice seed for planting, damage to rice from river flooding and fish, and low fish harvests, among others.

As to how the Cooperation works, with a small amount of financing, the Cooperation approaches villages with the idea of setting-up a village-level cooperative to create a village store. This initial effort usually takes several visits during which cooperative personnel ask a gathering of villagers to explain their local concerns, their needs, and their own means and priorities for solving such problems. The Cooperation explains its own program, its ideas, and its procedures and discusses these at great length with the villagers. The basic idea is that the local cooperative, if indeed it is created, acts as a pole of attraction for development interventions. The first step, however, is to define the membership of the cooperative and set up an executive committee. Membership in the local cooperative is voluntary. Each member, however, does pay an annual membership fee of 50 cents (US). The membership at large elects the executive committee. This committee, in concert with the membership, then identifies no less than 10 members of the cooperative who shall receive special training in the regional functional literacy unit in basic management techniques, account keeping, and such. At the same time, a potential village store manager is identified. He is also trained. Once necessary training is completed, a village store can be set-up and stocked with products and materials identified by the cooperative members. Items are usually those that can be purchased locally or in Gao and, thus, quite simple - rice, salt, sugar, etc. Items such as fertilizer, for example, which cannot be procured locally seem to be outside their ability to purchase - and are not here to be found on the cooperative shelves. The store is designed to be a profit-making venture, and prices are set accordingly, again by the members. Members and non-members alike can purchase at the stores.

Setting prices must include a sur-charge to cover all costs - salaries, loss, theft plus an additional percentage which may be distributed yearly to the membership, depending on its decisions. Usually, this percentage is reinvested. Funds for the original stock - \$4,500 - plus \$3,000 for building materials to construct the store are donated to the members of the local cooperative by the regional office. Members themselves must provide all other construction materials and must construct the necessary building(s) or hire a mason to do so. A local agent of the Cooperation is assigned to the village cooperative to act as technical counselor only when his advice is sought. Once the village store is functioning, it may act as a catalyst for other development efforts. The membership, through the executive committee, can ask for further training in functional literacy, training for health securist, for

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help from the forestry service to start a tree nursery, for help from ARS extension agents, and so on. The regional Cooperation in Gao has helped 36 cooperatives get started over the past 5 years. Each has created a village store and only 2 of the 36 have failed, for extraordinary reasons. These 2 have been restarted (one was in Ansongo).

Where some of the village stores have been started, local merchants who were allegedly gouging the local population have been forced out of business. These merchants frequently made 200% profits. The village cooperative stores buy grain from their merchants at prices determined by the members and resell, only to local villagers, at a cost 20% above purchase price. The cooperatives have two types of grain purchase and re-sell programs; both programs are started with funds for the original stock from the Cooperation. Under one program, they buy rice and re-sell it mainly for consumption purposes. Under a second program, they buy and re-sell rice on credit (150 kg. returned for every 100 kg. given on credit) for planting purposes. The reasons for the high repayment rate are clear. The seed does not leave the village, it is under the control and management of the cooperative members, it is available when needed, the farmers need not depend on an outside agency, and the 50% gross profit made on each loan ultimately benefits the cooperative members. (ARS's seed recovery rate has been about 15% over the past 5 years). With respect to this seed granery program, it is necessary that the different varieties of rice be separated from one another; otherwise, a farmer would end up planting all kinds of different rice varieties in the same field, something he would never want. It is unclear whether the cooperatives are taking adequate measures to separate the various rice varieties; it appears that in some cooperatives only one type of rice is being put into a given bag and labelled accordingly. In other cooperatives, such precautions are, from hearsay, not being taken. One thing is clear - the cooperatives need some kind of technical supervision in this respect, and they are presently receiving none. No decision is being made, for example, before the purchasing period begins (Oct.-Feb.) what varieties of rice should be purchased and how much of each. The needs vary greatly from village to village, because different varieties are planted in lowlands from uplands.

With regard to the seed granery program, there is presently an agreement between the Cooperation and ARS that no such program will be implemented so long as ARS (with its seed purchase program) is covering the area. Hence, the cooperatives in Tacherane, Gargouna, and Forgho have no program for purchasing and re-selling rice on credit for planting purposes - although some of the rice sold for consumption purposes is used for planting.

In the Cooperation's five-year program, they mention assisting cooperatives build water and fish control gates and screens; they estimate them to cost about \$10,000 each, from past experience. However, they are unsure whether there will be sufficient financing from Euro-Accord to do any such projects. Last year, they collaborated with ARS in building such gates/screens - the Cooperation put up the money, the local cooperative did the work, and ARS's engineer did the design work and supervision (something which the Cooperation must have if such a program is to be realized). The one project to date was an unqualified success.

ARS has an agreement with the Cooperation to collaborate as much as possible; this was one of their first efforts. The Cooperation has so many cooperatives under its supervision and so many potential interventions in its five-year plan (reforestation, medical training and supervision, animal credit

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program, women's artisan groups, formation/support, etc.) that they are simply not certain which of these programs will get financed. One thing the Cooperation states very clearly as result thereof - all programs will move very slowly, and some will probably never be realized.

IV. SUMMARY AND RECOMMENDATIONSA. RECAP

We have seen that the project has achieved some of its goals --the dike construction of compacted insubmersible dikes at two locations, construction of a new office building, a research and seed production facility which will soon be operational, the establishment or an extension infrastructure, and the provision of some agricultural inputs to the farmer. Further, the Office of Rural Agricultural Construction and Heavy Equipment (OTER), the division within the Malian Office of Rural Engineering responsible for large-scale agricultural construction works, was provided with a substantial amount of heavy equipment for earth-moving and compacting. The same organization, according to the engineering evaluation, competently executed a construction contract, overcoming formidable logistical problems to do so.

The objective of improving overall agricultural production through an extension outreach to 10,000 farmers in the Seventh Region remains to be realized. In this regard, the evaluation team concluded that the project design was faulty, based as it was on the assumption that the construction of insubmersible dikes would be the key element in helping farmers augment crop production. Had the land areas within the dikes been leveled, crop production through water control may well have been assured. This, however, was not the case. At the same time, it was seen that the technical package at the disposal of the extension service was not, given existing conditions, superior to that of the local farmers and may have indeed been riskier than traditional practices. The logistical difficulty of the timely procurement of selected seed from Segou and Mopti as well as the unproven adaptation of such seed for Gao conditions has been a constant problem. The extension agents were thus attempting to extend recommendations to farmers which both groups, it is likely, knew were inappropriate. Moreover, because of the mandate of the project administration and the design of the donor agency, extension agents and ARSG as an entity performed poorly in comparison with the cooperative movement which is more in tune with the needs and exigencies of farmers. Finally, in identifying women and paid laborers as project beneficiaries, the design team was completely off-track, for nowhere were laborers paid for submersible dike reconstruction and women can be said to have benefitted only where the construction of the insubmersible dikes resulted in much appreciated reduction of the heavy burden of physical labor expended on hand-built dike reconstruction and repair, especially when breaches occur, in which women are obliged to participate.

What we have as a resource on which to build on during the next phase is an established administration and an experienced extension service. Assuredly, some of the personnel, both office and field, need to have their skills upgraded. Further, they need to have an efficacious system to extend, one that is recognized by farmers as

being better than their own, in terms of production potential, risk minimization, and therefore better alternative strategies and choices.

The next two years should be viewed as a period of consolidation during which we attempt to assure the farmer of a crop, primarily by providing him access to water pump rental, and test and develop a set of technical interventions proven to fit climatic, economic, and social conditions. A continuation for a full project period of five years should be undertaken should this two year phase, as determined by AID evaluation, achieve laudable results.

B. RECOMMENDATIONS

1. Reorientation of ARSG Objective/Role

The evaluation team recommends the Action Riz Sorgho Gao be re-directed toward helping farmers assure and increase crop production via traditional methods as practiced in the Gao Region. ARSG extension agents will assume the role of technical counselors for agriculture. They should, therefore, be able to offer advice and execute demonstrations which support such advice. The agents should offer no inputs whatever except those of counsel and demonstration labor. They should distribute no seed, no fertilizers, no fungicides, no herbicides, no poison. They should not administer credit, nor will they seek reimbursement or repayment from the farmer for any commodity.

The evaluation team believes that this change in direction would help to build reciprocal confidence and respect between ARSG personnel and local farmers. This would set the scene for later vulgarization of technical practices which, under similar opportunities, conditions, or constraints, have been adequately proven to be superior to those of local farmers.

At the same time, ARSG should undertake research at the new station in Bagountie. The intent of the studies should be to identify techniques, varieties and practices which are better than local ones and acceptable to the farmer. (See Dat Van Tran's report, Annex C.)

2. Duties of ARSG

In line with the reorientation discussed under recommendation (1), the evaluation team sees the somewhat modified duties of ARSG as comprised of five broad areas of responsibility as follows:

(a) Research --as outlined in Dat Van Tran's research proposal, studies should be multipurpose in intent. The research program should identify the best aspects of the traditional system. It should test systems utilized elsewhere to determine their suitability under Gao conditions. Research should test local seed varieties --rice and sorghum. It should examine rice seed imported from elsewhere --both floating and standing varieties. Field preparation by oxen-drawn plows can be studied at sites

of differing soil conditions, at different times during the season, and using various size plows and cultivators. This aspect of the research will help determine the possibility of wide-spread adoption of animal traction by farm families.

The research should be multi-year, to be sure, but two crop seasons should be enough time to tentatively identify alternative technical packages for possible extension. Implicit in this is the recommendation that technical assistance in the form of a rice agronomist be maintained by the project, at least for the first two years and preferably longer.

(b) Training -- ARSG must upgrade the skills of its personnel. The evaluation team believes that most of the material and human resources necessary for improving ARSG performance will be found in Mali, a combination of IPRG, the rice agronomist Dat Van Tran, the ARSG heads of training and extension, farmers' knowledge of local conditions, local engineering expertise with water control and dike gates, the SECAMA pump repair team, and the cooperative movement's experience with grass roots organization.

The team believes that the director of ARSG should be sponsored to attend the University of Pittsburgh's special course of study for Francophone Africa development managers. The extension personnel can be given short workshops by research station personnel. At the same time, individual farmers selected by their peers might also be invited to attend such workshops.

Contract encadreurs presently working for the project should be removed from the lists of project personnel. However, in not all cases should they be replaced by monitors. It will have to be decided where extension agents should be placed in order to be most effective. This might be determined by comparing production figures with rainfall amount and distribution to deduce those locales where a serious farming effort is being made. Hence, where rainfall was sufficient but very low production is suspected or verified, no extension personnel would work. Nonetheless, all field personnel should participate in periodic workshops run by the ARS administration designed to refine their knowledge.

(c) Extension -- project extension personnel should extend knowledge and techniques rather than material inputs. As suggested earlier, agents should become technical advisors for agricultural development at the local, village level. The most efficient use of their knowledge would be realized if, as individual agents, they were each attached to a local cooperative. This, however, assumes three important points -- first, that the agents are very technically competent and generally know much more about agriculture

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than local farmers; second, that local members of the cooperative recognize the specialized knowledge of the agent and its usefulness for their situation; third, that the cooperative members invite the agent to associate himself with the local cooperative as technical counsel for agriculture.

Agricultural inputs would be provided, i.e., sold to individual farmers --whether or not they are member or non-member-- of the cooperative. These would include such needs --pumps, fertilizers seeds, fungicides, hoes, plows, insecticides, herbicides-- as whatever the technical counselor together with local farmers might identify as being technically and economically feasible given local conditions. The fact that the choice of locally-stocked and available ag inputs will be jointly made fairly insures the social feasibility of the stockpile. The joint choice of what to stock provides an entrée for the extension agent to offer his advice on how to best utilize inputs. A further benefit of this joint effort will be the development of a greater knowledge of farmer thinking vis-à-vis advice and inputs.

The evaluation team believes that the attachment, by invitation, of the extension agent to the cooperative will afford him more respect among the people he is trying to reach, will make him more viable and involved in community concerns, and thus give him better exposure to farmers who might individually or severally request his services. Attachment to the cooperative will, moreover, involve the agent in collective debate and decision-making. Equally important, the agent's role as account-keeper, credit-hawker --almost adversary-- will be abolished. Responsibility for credit management, repayments and provisioning will fall upon the local cooperative. The agent will be able to concentrate on teaching agriculture.

(d) Demonstration -- in their own personal plots, in farmers' fields, and at the research station, ARSG personnel must conduct demonstrations to prove to farmers that the extension advice so freely dispensed is indeed valuable. Of course, ARSG must ascertain what it needs to demonstrate and prove. It would, for example, be futile to demonstrate the use of chemical nitrogen if all farmers are already convinced of its technical effectiveness on particular crops, but have not yet been persuaded that using it is economically rewarding. If, as is sometimes the case, farmers complain that chemical fertilizers encourage the growth of weeds as much as they do the growth of food plant and that they consequently gain very little overall when they consider additional labor effort necessary to combat weeds, it would not be a wise expenditure of time to do fertilizer demonstrations.

What must occur is a performance by extension agents on their own publicized plots. These plots might test or demonstrate particular inputs or techniques about which the farmer wants more proof. The plots might simply be a test of extension agent ability to farm as well as do the local farmers themselves. If they cannot, then we are kidding ourselves if we think agents who cannot or will not farm can extend anything.

Such demonstration plots, of course, will serve as mini-research centers which, contending with the totality of local conditions as they must, will feed results to the research station at Bagountie. At this site, such tests can be repeated and verified or disproved, under more controlled conditions perhaps but still valid, and this should help the effort to come up with a viable technical package.

Other kinds of demonstrations, e.g., the effective use of animal traction, production of vegetables and fruits, can also be performed by the extension agent at his community site. The use of different kinds of fungicide, the treatment of sorghum prior to planting, and the effects of such would no doubt be welcomed by farmers. This assumes, we repeat once again, the competence of the agent on site, collaboration between agent and farmers, and collaboration between the agent and the ARSG administrative and research arms. And once again we emphasize that the best avenue to collaboration with farmers will be through the cooperative under their control.

(e) Administrator/Finance -- the administrative section of ARSG should be the coordinator of the research, training, extension, and demonstration activities. It should facilitate the dissemination of results obtained at the research station and in the field. It should have a reproduction unit for printing bulletins, technical or other information for both office and field personnel. The administration must be responsible for preparing quarterly budgets for submission to USAID and for providing sufficient evidence and accountability for the expenditures of funds. It must ensure that replenishments of operating funds are timely. Funds must be expended according to the appropriate line item in the agreed-upon budget and no expenditures should occasion a transfer of funds from one line to another without the express written approval of USAID. The Controller Office at USAID must assume responsibility for instructing budget and fiscal personnel at ARSG in proper procedures. To facilitate this, the Controller Office should put together a simple set of instructions, a written guide which can be translated into French and distributed to GRM project personnel responsible for finances. The guide should include instruction for budget preparation, account keeping, maintaining inventory records and control -- whatever the Control-

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ler believes will be helpful. At the same time, either the Controller or USAID project manager should procure the simple French language books from USICA on principles of financial management and accounting for distribution to the same GRM personnel.

To reduce recurrent operating costs for the agency, the evaluation team recommends that the numbers of both office and field personnel be reduced. All extension personnel should number no more than forty. This number is based on the assumption that field personnel need be stationed, at this time, at 32-35 locations, that a certain number will be ill, on leave of absence, or on vacation, and also that a rotation of agents through the office and research station would be useful for agents to learn the procedures and problems of the office and vice-versa. The evaluation team recommends that along with a limit of forty field extension employees, central office employees should be limited to twenty. This constitutes a 2 to 1 field to office ratio. Note that the office limit of twenty includes everyone --chauffeurs, janitors, watchmen, in short, all office employees. Research station employees must be limited to 10 people, again including everyone. Thus, ARSG's total employee figure should not surpass 70 people. Should production increases or a tested and proven technical package justify increasing the number of employees, such an increase can occur at the beginning of a third project year.

The administrative section must also coordinate vehicle use and maintenance. The initiation of training for chauffeurs by the Dutch mechanic, the head of the Cooperative garage in Gao, and the assignment of specific individual to particular vehicles will be a further step in the direction of reducing recurrent costs. Full primes should be paid to each chauffeur who maintains his vehicle and drives it carefully, otherwise primes shall be reduced in proportion to the problem. This prime should be paid monthly once a vehicle has reached the age of six months, or 15,000 kilometers, and only if the vehicle spent no more than one day during the month in the garage, this up to a vehicle age of eighteen months or 40,000 kilometers. Thereafter, the standard should be no more than two days per month in the garage to a vehicle age of 16 months or 80,000 kilometers. At this point, garage time should be viewed on a cumulative basis, such as two weeks during a six-month period.

The evaluation team projects a reduction in recurrent operating costs over Phase II. Concomitantly, project benefits are expected to increase. This will take the form of expanded rice production. If project financing can help assure crop harvest mainly through the provision of water pumps, it is not unreasonable to assume a 33% increase in total rice production over the best year we know of to date (1978-79, 6,200 tons of rice produced). Since some 8,000 hectares are planted annually and since local varieties are capable of yielding better than 1,000 kilograms per hectare, we can project a harvest in the near future of 8,000 tons, given decent rainfall and water pumps to get farmers through any slack rainfall period.

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ANNEX E

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORKAID 1688-01 (REV)
SUPPLEMENT 1Project Title & Number: Action Riz-Sorgho (688-0206)INSTRUCTION: THIS IS AN OPTIONAL
FORM WHICH CAN BE USED AS AN AID
TO LOGGING DATA FOR THE PAR
REPORT. IT NEED NOT BE RETAINED
OR SUBMITTED.Life of Project:
From FY _____ to FY _____
Total U.S. Funding _____
Date Prepared: _____

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Program or Sector Goal: The broader objective to which this project contributes: (A-1) An increased standard of living nutrition for the population of the Seventh Region of Mali.	Measures of Goal Achievement: (A-2) 1. Increased cereal production/reduction of cereal losses. 2. Decreased time spent by women in grinding sorghum and hulling rice.	(A-3) 1. I.E.R. studies 2. Village-level surveys	Assumptions for achieving goal targets: (A-4) 1. That improved research in rice and animal traction is made available to farmers, and they are receptive. 2. That women find it economically viable to use mills.

1740-70 (1-72)
 FORM 1

PROJECT DESIGN SUMMARY
 LOGICAL FRAMEWORK

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

Project Title & Number: Action Riz-Sorgho (688-0206)

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NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
<p>Project Purpose: (B-1)</p> <p>(1) To increase cereal production, reduce cereal losses in the chronically grain deficit Gao area; and (2) to introduce the farmers in the area to the concept of technological development</p>	<p>Conditions that will indicate purpose has been achieved: End-of-Project status. (B-7)</p> <ol style="list-style-type: none"> 1. Increased rice and sorghum production/reduced cereal losses in project area. 2. Farmers using mills, animal traction, new rice seed varieties, fungicides, water pumps, and double cropping practices 	<p>(B-3)</p> <ol style="list-style-type: none"> 1. Project evaluation. 2. ARS annual reports. 3. Contractors' reports. 4. Village-level surveys. 5. ARS extension agents' reports. 6. Baseline production studies, yield sampling. 	<p>Assumptions for achieving purpose: (B-4)</p> <ol style="list-style-type: none"> 1. That research produces at least one irrigated rice variety adaptable to area, and farmers are receptive to rice cultural changes necessary to grow irrigated rice and to double crop; or research produces a standing variety that is truly better than local varieties and does not have long growing cycle. 2. That ARS agents develop the ability to extend this new technology effectively.

PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

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

FIELD NUMBER: 10-239
SUPPLEMENT 1

Project Title & Number: Action Riz-Sorgho (688-0206)

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NARRATIVE SUMMARY	OBJECTIVELY MEASURABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
Project Outputs: (C-1)	Magnitude: (C-2)	(C-3)	Assumptions for achieving outputs: (C-4)
<ol style="list-style-type: none"> 1. Functioning research program in rice and animal traction in two different flood plains. 2. Physical infrastructure for research program on farmers' fields at Gargouna. 3. Strengthen ARS management and technical capability for rice research. 4. Farmers using water pumps and fungicides. 5. Farmers receiving seeds from granary programs on timely basis, and transplanting more. 6. An extension service capable of effectively extending agricultural services and advising cooperatives. 7. Mills operating viably by women's groups. 8. Effectively operating seed granary programs. 9. Installation of water control gates. 10. Strengthen relationships of agents with village cooperatives. 	<ol style="list-style-type: none"> 1. Research programs operating in 2 flood plains. 2. 2 Malians trained-external 12 Malians trained-internal 3. Research station building constructed. 4. Increased in _____ tons cereal produced/year. 5. Mills operating in 3 villages by corp. members. 6. Seed granary programs established in all 4 sections of project area. 7. 5 water control gates installed. 8. ARS agents working closely with all 3-4 coops. in project area. 	<ol style="list-style-type: none"> 1. Site visits. 2. Contractors' reports. 3. ARS reports. 4. Baseline production studies yield sampling. 5. Cooperation's reports. 	<ol style="list-style-type: none"> 1. That the technical advisor is effective. 2. That motivated ARS agents can be located and used/trained effectively. 3. That the mills and pumps are operated effectively and viably, and are kept in good repair by ARS. 4. That the cooperative movement in the 7th Region accepts ARS's proposal to encourage cooperatives to establish granary programs in the project area, and form women's groups to operate them; and, second, that the cooperatives are receptive.

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PROJECT DESIGN SUMMARY
LOGICAL FRAMEWORK

Project Title & Number: Action Riz-Sorgho (688-0206)

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

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
<p>Project Inputs: (D-1)</p> <ol style="list-style-type: none"> 1. TA-1 rice research advisor (34 PM). 2. Training, both external and on-the-job. 3. Creation of an irrigated rice research polder protecting 5 ha. 4. Commodities (pumps, tractor, mills, fungicides). 5. Installation of fish and water control structures. 6. Support to ag. extension service to extend improved ag. techniques coming from research program. 7. Fund for granary programs. 	<p>Implementation Target (Type and Quantity) (D-2)</p> <p>See Financial, Table Annex _____.</p>	<p>(D-3)</p> <p>Controller's disbursement records.</p>	<p>Assumptions for providing inputs: (D-4)</p> <ol style="list-style-type: none"> 1. Funds available from AID on a timely basis. 2. TA recruitment performed on a timely basis. 3. Génie Rural designs 5 ha. research plot on a timely basis. 4. Villagers are willing to do the manual labor in constructing gates.

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ANNEX F

QUALIFICATIONS AND SCOPE OF WORK
FOR RICE PRODUCTION/RESEARCH ADVISOR

- Education: MS or MA in Agronomy with special training or experience in paddy rice production.
- Experience: 5 or more years experience in research/production programs for irrigated rice. Should have experience of working in LDC's. Experience in Africa preferred to that in Asia or elsewhere. Experience with research work preferred.
- Qualifications: French language ability at minimum S-2 plus, R-2 is required. Full knowledge of rice cultivation, including seed bed preparation, pest control, rice diseases, fertility requirements and, especially, water requirements and control. Ability and willingness to live in a remote rural town. Ability to conduct a training program for 4-5 Action Riz-Sorgho extension agents working at the research station. Excellent physical condition.
- General Responsibilities: Work under the Director of Action Riz-Sorgho with ARS counterpart-agronomist and IFR agronomist, plan and implement 3-year research program at ARS's research station 5 miles outside Gao and on a 5 hectare irrigated rice plot on a farmer's field in Gargouna (15 miles from Gao). Concentrate efforts on providing technical leadership for the conduct of agronomic research including testing and identification of sorghum/rice varieties (both floating and irrigated) and of cultural techniques suitable for these crops, including animal traction and the development of the most profitable crop sequence systems for the area (including testing double cropping).
- Specific Duties:
- Test and identify the most suitable floating and irrigated rice varieties, and sorghum varieties if possible, for the Gao area at ARS's research station and on a 5 hectare irrigated plot (to be constructed) on farmers' fields in Gargouna.
- Develop adaptable and profitable agronomic techniques, including animal traction, needed to raise rice production.
- Advise and assist ARS counterpart agronomist and ARS Director on the design and conduct of agronomic research, and conduct training of ARS extension agents assigned to the research station at Tacherane.
- Responsible for advising on operation and maintenance of all equipment at the research station;
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including a tractor to be purchased for use at the station in leveling land.

Maintain close contact with all related research activities in and outside Mali to insure that latest research and appropriate varieties as well as equipment are tested if applicable to the project area.

Study present flood irrigation practices for rice and sorghum production, to identify constraints, and to test alternative irrigation practices and water management practices, including double cropping of rice.

Analyze economics of current farming practices of proposed interventions.

Report to the ARS and USAID/Mali project directors on program success and problems, and make recommendations for modifications in the program as needed.

Supervise baseline rice paddy production yields in the project area to ensure sufficient data for yield comparison purposes at time of final project evaluation - - in collaboration with ARS and IER.

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