ACTION RIZ-SORGHO PROJECT EVALUATION

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I. PROJECT AND EVALUATION BACKGROUND

A. Introduction

Beginning in late 1973, the IBRD provided emergency, drought-relief funding to increase agricultural production on 2000 hectares of Niger River flood plain in the Gao Region. Funding which totalled $387,500 ended in December 1975. Since internal regulations prohibited IBRD from providing further funding as a follow-on to emergency relief, the Malian government asked USAID for assistance to continue and expand what had begun so auspiciously.

Responding to the Malian request, USAID/Bamako fielded a Project Review Paper team, a Project Paper team, and later a Project Paper revision team. This process began in January 1975 and the Project Paper was completed in final form in July 1976. USAID funding began in fiscal year 1977 and was extended once to run through June 1981 for a total amount of $3,878,000.

Evaluation of the technical, economic, administrative, social, and environmental aspects of Action Riz-Sorgho was begun by the Regional Economic Development Services Office for West Africa and by USAID/Bamako staff in December 1980. The evaluation will help determine whether American assistance to the project should continue for an additional period of time or if funding should cease in June.

Thus far, evaluation team members have made three field trips to Gao and the project agronomist is now on site. This report summarizes the results of the evaluation to date and sets forth some recommendations for consideration.

B. The Action Riz-Sorgho Project Goal

An increased standard of living and nutrition for the population of the (then) Sixth Region of Mali was the stated goal.

C. The Project Purpose

The purpose was two-fold: (1) to increase cereal production in the chronically grain deficit Gao area; (2) to introduce the farmers in the area to the concept of technological development.

D. Inputs

Money and technical expertise were thought to be what it would take for the project to achieve success. Thus, capital was to be furnished for:

- repair of submersible dikes surrounding 5000 hectares
- construction of insubmersible dikes
- installation of fish and water control structures
- purchase of improved seed
- purchase of hand tools
- creation of a field agricultural research station
- support of the technical and administrative staff to vulgarize improved agricultural techniques including the use of selected seed, fungicide, and fertilizer.

E. Projected Outputs

With the construction of insubmersible dikes and repair of already-existing submersible dikes, it was expected that a substantial increase in protected hectarage would result in higher yields and greater overall production. Animal traction, fertilizer, fungicide, and selected seed variety demonstrations were to constitute the improved technology expected to increase production. At the end of the funding period, the project was supposed to have achieved:

(1) the construction of insubmersible dikes with water and fish control gates and screens protecting 5000 hectares of flood plain planted in rice yielding 1300 kilograms per hectare (up from 550);

(2) the manual repair of submersible dikes along with installation of water control gates and fish screens to protect an additional 5000 hectares of flood plain planted in rice yielding 900 kilograms per hectare (up from 550);

(3) sorghum yields averaging 600 kilograms per hectare (up from 450) on at least 3300 hectares through furnishing improved seed and teaching better methods of cultivation;

(4) annual demonstrations of the improved technology mentioned above performed by project extension agents in every village included in territory served by Action Riz-Sorgho;

(5) the introduction of new seed varieties and better farming practices to 10,000 farmers;

(6) an overall increase of 3750 tons of cereal production per year in Gao area which would effectively reduce the amount of food grains imported to Gao.

F. Intended Beneficiaries

According to the Project Paper, the primary benefits were to go to approximately 140,000 grain consumers comprising some 20,000 poor farm families in the Gao Administrative Region.

Secondary benefits were to be derived by laborers who were to be paid for repairing submersible dikes or for working on the construction of water control gates or fish screens.

Women were identified as particularly important beneficiaries. The introduction of the technology would, it was stated, "decrease the specific demand for women laborers during certain production stages (primarily weeding) ..." since chemical herbicides and small mechanical weeders would take the place of hand labor. Moreover, such a decrease in the demand for labor would allow women the freedom to pursue "home gardening, handicrafts, or other economic activities which could increase farm family income" (PP, p. 11).

II. PROJECT ACHIEVEMENTS

(1) Insubmersible dikes protecting 1310 hectares of rice polders on the flood plains adjacent to Tacharane and Gargouna have been constructed. The project has thus missed its goal in this regard by 3690 hectares.

(2) Repair of flood gates and fish screens serving about 1000 hectares has been undertaken but no numbers are available which indicate how much actual repair has been achieved nor how many polders affected. The project remains far short of its goal of rehabilitating traditional dikes protecting 5000 hectares of land.

(3) Sorghum was sown this year (1980-81) on 3676 hectares of which 3374 were harvested. This surpasses the project goal of 3300.

(4) Average sorghum yield per hectare this year (1980-81) was 444 kilograms. Highest yields were achieved in the 1978-79 season, reportedly 512 kilograms per hectare. This falls short of the project goal of an average per hectare sorghum yield of 600 kilograms.(1) Thus, the project has had no impact whatsoever on sorghum yield per hectare.

(5) Total sorghum production this season (1980-81) was more than double that of the previous year--1932 tons versus 851 tons. The 1979-80 season had heretofore been the best production year.

(6) Total rice production has gone up each year since 1976 except for the disastrous season of 1979-80.(2) Production figures in tons are:

1976-77	4295
1977-78	4776
1978-79	6173
1979-80	2828

(2) 1980-81 figures were not yet available when evaluation personnel visited the project area.

(7) Hectarage planted with selected rice seed varieties increased by 65% in 1977-78 but the 1979-80 season had decreased to 1976-77 levels.

(8) An office building has been constructed. The building provides space for all Gao-based administrative and agricultural personnel.

(9) A rice research and seed multiplication station is under construction at Bagoundie, seven kilometers south of Gao, and is projected to be operational by June 1981.

(10) Three Malian agronomists received eleven weeks of stateside training in agriculture and extension methods, Coulibaly, Togola, and Djemdé (management course).

(11) Some demonstrations of cultivation using animal traction have taken place at each sector headquarters. Whether they were professionally done has been questioned by some farmers.

(12) Project extension personnel theoretically work with approximately 6400 farmers. If this is correct, theproject has fallen 3600 short of its goal of working directly with 10,000 farmers. The evaluation team believes that the figure of 6,400 represents the number of farmers who work in the geographical areas fully covered by ARSG and, if this is indeed the case, the number of farmers actually touched by the project is far less than 6,400.

(13) Support in the form of± $600,000 in earth-moving equipment given to OTER. The construction brigade of OTER which did a fine job of building the dikes at Tacharane and Gargouna gained further experience in the planning, execution, and logistical support necessary to achieve such construction.

III. ASSESSMENT OF PROJECT FEASIBILITY

A. Technical

Here, it is first necessary to examine several important assumptions, both explicit and implicit, on which project success depended. The project planners believed that:

(1) "the kingpin of the proposed intervention for rice improvement is the construction of permanent, insubmersible dikes which will assure a complete control of water flow into the protected areas." (p. 6) The dikes were to be constructed with sluice gates and fish screens, the latter to keep rice plant-eating fish out of the diked perimeters.

(2) complete control of the entry of river water into the perimeters would allow farmers "to transplant nursed seedlings with the rising water rather than broadcast seed and have to depend on uncertain rains" to nurture the plants until the river flooded the perimeter land. The intent was to open the sluice gates only after the river had begun to rise and only enough to allow a water rise in the perimeter of about one centimeter daily until the transplants had taken root and three centimeters daily thereafter.

(3) farmers would recognize and adopt the efficiency of this method—both in terms of greater yields through, for example, appropriate plant spacing and also a guaranteed crop.

(4) the method would eliminate the need for supplementary pump irrigation to help the rice survive the pre-flood period if the frequency and distribution of rain was inadequate.

(5) farmers would adapt the use of selected, recommended seed which, it was felt, would out-perform local varieties.

(6) farmers, adapting this method, would alter their traditional agronomic schedule, since the proposed method called for planting rice six weeks later than is the current practice.

(7) farmers prefer transplanting to broadcasting since the latter demands that hard ground be worked with a hoe at a hotter time of the year.

There are a number of problems posed by these assumptions.

First and particularly critical was the lack of understanding of the traditional system of cultivation. This was essentially ignored by the planners. The implications of transplanting only as the flood rises and thus moving the agricultural calendar back by six weeks are telling. This suggests that transplanting would take place over a period of several weeks, i.e., until the flood reached all areas in the unleveled perimeter. Low spots would be planted first, then the next lowest, and so on until the entire perimeter was planted. This is the only way planting could be accomplished, yet by suggesting that the farmer transplant, the PP seems to imply that land leveling would have been accomplished at the same time that the dikes were constructed. Nowhere in the PP is this problem touched.

The evaluation team estimates that the average cycle of local rice varieties is 150-160 days. The recently arrived project agronomist, Dat Van Tran, estimates their cycles to be 180 days. Bear in mind that the local production system incorporates some six weeks of rainfall into the growing cycle. Using the cycle of 150-160 days and considering that broadcasting is done about June 15, we can deduce that the rice harvest begins about December 15. The evaluation team noted that by January 15 the harvest was entirely complete. The rice harvest thus demands two-four weeks of the farmers' time.

The methods suggested by the project planners, on the other hand, would have farmers move their harvests back by six weeks because planting would have been done six weeks later than usual. This would have several consequences. First, the harvest itself would be extended over a longer period of time because maturity would be reached at different times. The birds would arrive in force as the crop was maturing and, accordingly, the fields would be likely to suffer greater losses to birds. Because this period would coincide with the coldest period of the year, people would be less likely to be out in boats to scare birds away from the rice. Moreover, working in the river during this very cold period would subject people to illness brought on by the cold weather. The harvest process itself—gathering, beating, winnowing, transporting to storage—would be likely to carry over well into February and perhaps even the month of March. Thus, it would conflict with the preparation and planting of sorghum fields, normally begun about January 15. There could be conflict with cattlemen and their herds returning from distant pastures and water holes to graze and water along the river through the dry season. Adult males would be leaving the area to go off in search of dry season employment. And a final consideration might be the fact that the rice would be ready to market long after the time when people need money to pay their taxes. These must usually be paid by January 1 and farm families are obliged to sell a portion of their rice harvest to raise the necessary money. It is clear that the new method would demand more labor from the farmer than does the traditional method. Perhaps farmers would view the potential for increasing yields as enough of a justification for adopting the suggested methods, but results seen do not seem to bear this out. Few, if any, farmers have adopted the new scheme.

It seems that if the interiors of the perimeters had been leveled, the new method would be feasible, given also a shorter-cycle rice variety which

had proven itself in the Gao area. It is clear that controlling the flood entry into the perimeters by the construction of unsubmersible dikes with appropriate gates and screens was not the key to either assuring or increasing rice production. The conception of the dikes as the "kingpin" of the proposal was inherently wrong. So was the rejection of motorized water pumps.

Let us review the technical possibilities the design team had to choose from. The SATEC report referred to in the Project Paper suggested four different possibilities for development interventions in the Bourem-Anzongo corridor. It behooves us to take a brief look at these as well as the suggestions of the ARSG agronomist Dat Van Tran. In addition, we will examine what the PP opted for in light of the SATEC suggestions. Lastly, we will look at the experience in Niger with rice perimeters along the river.

The SATEC study described four improvements that might be considered for financing to increase agricultural production in the Seventh Region. Briefly, these were:

(1) Support the traditional system, that is, the areas of hand-built dikes, but build small dike openings and fish grills, and provide small water pumps and handtools, such as picks, shoevels, wheelbarrows, and such;

(2) With machinery, build submersible dikes with openings and grills, and provide small water pumps;

(3) Build insubmersible dikes with openings and grills, and provide small water pumps;

(4) Build insubmersible dikes with control gates and grills as in (3) above, but level the interior of the perimeter, install large, diesel-powered pumping stations. This is the complete irrigation system.

The SATEC analysis concluded that each of the first three possibilities could lead to slight increases in production, but that the increase in investment demanded by possibilities (2) and (3) could not be justified by enough of a production increase. Possibility (4) could lead to substantial increases in production and would be economically justifiable if the investments could be amortized over thirty years. The choice of intervention, therefore, would clearly be between the first (low investment, small increase in productivity) and the fourth (large investment, large increase in productivity).

The advantages and disadvantages of the two possibilities were outlined:

<u>Possibility Number 1</u>

Advantages:

- could be done on almost all of the 17,000 hectares irrigable along the river corridor;

- could be started immediately, therefore have immediate payoffs;

- small investment;

- farmers would be involved;

- there would be no social disruption, i.e., each exploitant would retain his autonomy and control of land, freedom of choice of what, when to plant;

- farmers already know the basic techniques; only support via improved seed, fertilizers, fungicides, technical counsel, pumps, carburant, maintenance of pumps.

Disadvantages:

- the farming system would remain essentially traditional;

- productivity would remain low and there would be little increase in production per hectare;

- numbers of pumps would require a management system for use, provisioning in fuel and parts, maintenance, and user charges;

- questionable if region could become self-sufficient in food production.

Possibility Number 4

Advantages:

- intensification of agricultural production;

- two crops per year;

- diversification into new cereals (e.g., wheat) and vegetables;

- possibility of employment for agricultural labor on plots rented to farmers;

- consolidation of an intensified production effort on a few thousand hectares rather than 17,000;

- much greater economic return;

- region self-sufficient in food production;

- landless farmers would have chance to rent land at reasonable price.

Disadvantages:

- would take time to implement, three to four years;

- cannot be done everywhere; suitable sites along river corridor consist of only some 3,000 hectares;

- farmer would have no voice in implementation and exploitation;

- implies social disruption, through land reform, redistribution of land resources, change of agricultural methods and calendar, and would thus require extensive sociological studies;

- much larger investment required, estimated at the time of the report at $3,500/hectare;

- full production would only be realized over long term.

For both possibilities, SATEC saw the need to create an agricultural organization to provide administrative and extension services, to oversee a research and seed production facility, and to handle the provision of ag materials, equipment, and credit.

Over the long term, SATEC opted for possibility (4). However, during the period required for studies to implement the classic irrigation system, the report suggested that immediate support be provided under possibility (1) and continued in these areas--that is, the 14,000 hectares untouched by the complete irrigation system of (4)--where traditional cultivation methods would remain the norm.

It is interesting to note that the design team for the Action Riz-Sorgho Gao adopted none of the four development possibilities set forth in the SATEC study. The plan recommended in the PP is perhaps closest to SATEC possibility (3), including the construction of insubmersible dikes, but the case made against small pumps in Annex A of the PP indicates the design team's lack of understanding of farming practices and exigencies in the river corridor.

Notwithstanding the cost of completely constructing a fully irrigated perimeter such as SATEC recommended, the evaluation team took a necessarily quick look at rice perimeters in Niger. The irrigation systems along the river south of the Mali-Niger frontier are complete systems. Two crops are harvested annually and the average crop yield is 4,000 kilos, or 8 tons per hectare annually. Full exploitation of the perimeters has required redistribution of land and thus caused some social dissatisfaction. Still, it would seem that real incomes have increased considerably. If the farmer working one hectare sells his 8,000 kilograms of rice to the state at the official price of 55 CFA/kg, he derives a gross income of 440,000 CFA or nearly $2,000, no small amount in light of the country-wide annual per capita income in Niger. Even after the farmer has paid his user's fee of 50,000 CFA (which includes water), withheld the amount of grain he needs for his own family consumption, reimburses his credit for seed, fertilizer, and the like, one would conclude that his income is greater than that of most Sahelian farmers.

The Niger government had contracted with expatriate firms to construct its perimeters, but found that the cost averaging, everything included, about $23,000 per hectare was excessive. The government has since formed its own agency, the Office National des Amenagements Hydro-Agricoles, and it is said to have lowered the costs of perimeter construction to

$12,000 per hectare. The government does not seek to recoup the amount of investment through user fees. The latter do, however, cover the annual operating costs, including those of personnel, of the perimeter.

Dat Van Tran's suggestions for increasing cereal production consist of two steps: first, control the river flood and supply water efficiently; second, change farmers' agricultural methods (see Van Tran's report attached here as Annex C). The first step has been partially accomplished at Tacharane and Gargouna with the construction of the insubmersible dikes. What would have to be done in addition is the "floating canal" construction and pump station installation. This would require further investment by USAID. Whether the second step could be achieved is highly questionable. All evidence suggests that changing farmers' methods of cultivation is extremely difficult. Van Tran recommends that his suggestions be attempted in a pilot project to run over five years.

The evaluation team, as will be seen in the recommendations section, has opted for a modified version of SATEC's suggestion, i.e., support for and refinement of the traditional system. Van Tran's ideas will need much study to assess their feasibility. Testing his suggestions should be started but limited to the research station over the next two years.

Economic Analysis

Production:
The surface planted to rice and harvested has actually declined as a result of the project as a result of the space requirements of the dikes themselves and other factors. Nonetheless, the area loss is more than offset, in terms of gross output, by the approximate doubling in average yield per unit area. This estimated current yield exceeds the project's forcasted increase by about forty percent. There is short-term expectation that the total cultivable surface will be expanded by three hundred hectares but this will be 3000 hectares less than the total anticipated in the original project document. Sorghum production has not been affected although some small improvement had been expected.

Current Gross Added Value of Production
Pre-project output on ten thousand hectares was 5000 MT/season; present output reflecting the effects of the project is 6700 MT/season thus the improvement in real output of 1700 MT/season is a 34% annual increase. This increase is currently valued at $714,000 equivalent of milled rice at Gao retail prices. Net income is estimated to be $589,000/annum. This compares with the project paper's forecast of $596,000 by year four (1980). Much of this financial gain can be attributed to a recent rapid rise in the retail price of rice which had not been anticipated by the project forecasters. In fact the actual physical production increase is only about one-half of that which had been forecast (1700 T actual vs. 3550 T forecast).

Project Costs
Investment. The initial project investment was $3.7 million expended over approximately three years time to achieve the present (1980) level of production. At an interest rate of 12%/annum; assuming uniform drawdown of the investment over the three years, the implied interest cost over the three unproductive years is estimated at $880,000. Hence total capital cost to AID at onset of "full production" of the 6700 improved hectares (1980 season) was $3.7 million plus $880 thousand or $4.5 million. But, in effect, there are other expenditures which can be identified as "capital" -- those which are investments in human capital, the training through extension and otherwise of the labor and management of the irrigation system. We estimate that this investment will be spread over approximately six years beginning in 1977 and will amount to approximately $230,000 per year such that in year seven no further investment will be made and only recurrent costs of $115,000/year will be generated. The annual training and and extension investment expenditures for the first three years (at $230,000 per year) plus implied interest is calculated at $690,000 + $164,000 or $850,000. Hence the total investment cost at commencement of production year one (1980):

AID Project Cost	$3.7	million
Implied interest	.88	million
Training + extension	.85	million
Total	$5.43	million

Finally, during the second three year period (1980-82) further training and extension will cost $690,000 plus interest. Thus present (1980) value of the total investment cost is approximately $6 million.

Recurrent Costs
The farmers in the new perimeters are working 6700 hectares rather than the 10,000 ha worked prior to the project; hence we assume no net incremental labor production costs to the farmer; a small ($2/Ton) increase in post harvests costs and central management costs of $115,000 annually (for maintenance, inputs etc.). Hence aggregate annual incremental operating costs are $115,000 + $13,400 or $125,000.

Life-of-Project Income at 1980 prices, assuming a project life of twenty years and constant annual incremental operating costs of $125,000, annual gross incremental income of $714,000, annual incremental income, not including capital costs would be $589,000. Aggregate incremental income not including investment costs over the twenty years life-of-project would be $11,780,000 and the present (1980) value of that incremental income would be $5.5 million. The value of the total project investment in 1980 as we have seen was estimated at $6.0 million. Thus the benefit/cost ration of the project in 1980 is estimated at 5.5/6.0 or .90, not bad in strictly project financial terms, not including (expected positive) externalities not to mention the contribution to area food security, independence from climatic change, etc.

Unit Cost and Benefits
The project has provided partial water controlled irrigation to 6700 ha at an eventual total investment cost of $6.0 million or less than $1000/hectare, and there is the possibility to extend the irrigated area behind the dikes through land-leveling, probably at much lower unit costs. The project has been able to double unit yields in rice on a one crop basis; moreover the current output of 1000 kg/ha is itself modest and could be expected to be improved once the perimeter is smoothly operational.

Considering the average family tillage of rice of approximately 1.1 hectare under the project whereas formerly the average was 1.8 ha, the gross augmentation to average family income is (1.1 ha X 1000 kg/ha) --(1.8 ha X 500 kg/ha) or 200 kg rice valued at $86 per year per family gross or approximately $60 per year net of investment costs. This can be accepted as the estimated annual average increase in family income resulting from the project if, in fact, the farmers are paying actual perimeter maintenance and operating costs.

Summary of Economic Effects of ARS

Production	Before Project	After Project		Change
		EOPS	Actual	
RICE				
Area harvested (ha)	10,000	10,000	6,700	- 3,000
Yield (kg/ha)	500	855	1,000	500
Production (Tons)	5,000	8,550	6,700	1,700

Finances

Investment (1980)	$6,000,000
Net Annual Income (1980)	$ 589,000
Present Value 20 Year Income	$5,500,000 at 10% discount rate
Benefit/Cost Ratio	0.92
Project Internal Rate of Return	8%
Incremental Family Income	$60/year

C. Administrative/Financial

1. Personnel - There have been few changes in the ARSG administrative staff since last year, the exception being the naming of the former Assistant Director as Director. The new director has been acting director often enough in the past and otherwise closely associated with the project that the discontinuity which often occurs in directorship changes has not been a problem in this case. As confirmed in ARSG's annual report, the present staff lacks in capacity to carry out a program of improved agricultural techniques. Especially weak are the critical sections of rural works (construction and maintenance), supply (motor pool and pumps among other responsibilities), and training (animal traction, etc.). During the evaluation visit of the REDSO engineer, himself a former AID contractor working on the construction phase of the ARSG insubmersible dikes, he detailed the following examples:

- Over half of the ARSG motor pumps lying idle and non-operational;
- Failure to respond to farmers' requests for small dike construction and pumping services (in fact many villagers were unaware of the availability of ARSG pumps for rent, despite the presence of extension personnel in their village);
- The inability to install or to conduct a test program on an animal-powered flow pump;
- Infrequent and inept animal traction demonstration;
- Supply rooms in disarray (much improved at present);
- Many project vehicles either disabled or in poor repair; (also improved), and
- Absence of records on construction costs.

The project paper, which on pp 22 and 24 lists qualification of technical staff members, such as an agronomist with water resources background, an irrigation engineer, and agricultural and construction technician, grossly exaggerates professional titles. "Excellent performance--- exceptional ability---blend of talents--- fully adequate---" are not staff descriptions, but simple overstatements. Neither the project staff nor the project management are technically trained or focused enough to meet the needs of the agricultural situation. This lack of ability is exacerbate by the seeming failure of the project's direction to give priority to technical needs. Engineering and logistics are generally downgraded within the project's managerial framework.

It was clear to the evaluation team that a communication or attitudinal problem exists between the ARSG administration and the farmers in the project area. In fact, ARSG/farmer relations appear to be strained. The attitude of some of the ARSG staff was represented several times when they stated the need to "oblige" or even force farmers to follow ARSG instruction. Yet the staff lacks the technical ability to know specifically what agro-

technical package to introduce in consonance with farmers' interests. Illustrative of this extension service/farmer relationship was ARSG's unwillingness to change the planned dike alignment to better suit village needs prior to construction and the difficulty experienced with farmers' operation and maintenance of the dike system.

Extension agents varied greatly in terms of levels of competence, interest and training levels. The training, in fact, received by many of the extension workers is of extremely short duration (two weeks) and many lack previous in-the-field experience in intensive production methods. The evaluators even observed hostility directed against some agents by villagers in meetings held by the evaluators. Some extension personnel do not speak Songhai, rendering them useless at the local level. If one can assume that ARSG's figures for numbers of participating farmers is correct, there is an extension worker to farmer ratio of 1:214. Despite the serious problems between ARSG and the people they are supposed to be aiding, the director, when asked his most pressing project needs, replied with construction of extension agent housing, a more independent (from AID) accounting procedure, and greater choice of commodity purchases.

2. Logistics/Administration - A basic assumption inherent to implementing a project in the Seventh Region was that logistical problems -- formidable in such an isolated region as Gao -- can be sufficiently overcome. The Niger river is navigable only five months a year for shipment of project materials and commodities from Bamako, and the overland route is in an abysmal state at best. Many shelf items for project use are shipped from Niamey and purchased by ARSG from local merchants. Perhaps the most serious logistical obstacle to the ARSG technical impact has been the necessity to procure improved rice seeds from production centers in Segou and Mopti. This procedure has been extremely costly ($35,000 per truckload). Also seed stocks have often been unavailable for purchase by ARSG. This was a major factor in the disastrous rice harvest during the 1979-80 campaign. It is clear to the evaluation team that this problem, seemingly one of logistics, would not have existed had the research station, together with concurrent ARS activities, been able to develop a true adapted technical package, including improved rice seed for the Gao region. As the provision of so-called "improved seed" was the provenance of far away centers - even then Gao being a low priority for supply - logistics did at that moment enter into consideration. With this exception, the logistical problems of undertaking a project in the Seventh Region have not presented insurmountable difficulties.

After being housed since 1976 in an inadequate building belonging to the Regional Assembly, the ARSG administration moved to a newly constructed and suitable structure in December 1980. The cost of this building was 14,000,000 FM-- an amount less than had been expected and one that ARSG undertook and successfully completed by force account.

Action Riz-Sorgho complains about their own administrative problems vis-a-vis USAID. These include the fact that USAID can and sometimes does procure project materials without ARSG knowledge--thereby reducing their budget that ARSG may have planned for other uses; that AID reimbursements are often untimely in that they do not assure the availability of funds at the start of a campaign; that ARSG has control of only project operating expenses. These rather universal complaints deriving from the way that AID implements and funds projects--all projects--in the field.

3. Project Expenditures

	LOP Budget $	Earmarked to Sept. 30, 1980 $	Earmarked March 31, 19: $
Technical Assistance	175,000	167,043.36	167,186.05
Training	41,000	28,795.23	28,795.23
Commodities	1,281,000	1,120,665.35	1,136.529.91
Dike Construction	1,566,000	1,742.086.40	1,742,086.40
Operating Expenses	765,000	604,142.72	700,757.47
Credit Funds	50,000	-0-	-0-
Total	3,878,000	3,662,733.06	3,775,355.06
Available as of March 21, 1981		$102,644.94	

D. Social

1. The Social Feasibility of the Technical Package

The technical package was assumed to be a good one that the farmers would accept.

We must, consequently, look at the various aspects of the technical package and examine them from the perspective of farmers' acceptance or rejection. The technical package can be laid out as follows:

- water control by the dikes and gates
- fish control by the screens
- selected, improved seed
- fertilizers
- fungicides
- transplanting
- change of agricultural calendar
- extension advice to farmers to help effect change via more productive techniques.

However, before discussing the technical recommendations as they might be accepted by farmers, we should take a brief look at the concerns of the farmers. The strategies he adopts may then be better understood. Some important concerns are:

- having access to enough labor --through family ties, alliances, village cooperative work groups, or financial or commodity resources to engage hired labor-- to keep dikes repaired, prepare fields, plant, maintain, and harvest;
- having enough land to plant; being able to spread the crop risk over several plots of different soil types and elevations;
- having enough seed to plant; different varieties for different locations and soils, with different flowering times and maturation;
- timing the broadcasting with the onset of the rains in advance of the flood;
- hoping the rains will be sufficient to sustain the plants until the arrival of the flood and its rise into all areas of the perimeter;
- having additional seed to sow if the plants die from lack of moisture;
- slowing the rise of the flood in the perimeters by the water control devices --dikes and dike openings;
- hoping the dikes will hold;

- keeping predatory fish out of the rice field, or at least minimizing their destruction of the rice by such means as poison;
- harvesting the rice before the birds arrive in large numbers when it becomes impossible to control their destruction;
- harvesting before it becomes too cold to be constantly working in water;
- harvesting over a spread of time so that labor resources can be allocated over time;
- harvesting before it is time to plant the sorghum fields.

a. Water Control By Dikes and Gates
First, it must be pointed out that the dikes and gates did not assure complete water control but simply the entry and, to some extent, the retreat of the flood. The farmers view the dikes as technically beneficial because they help assure that their plants will not be inundated and asphyxiated by fast-rising water. In addition, because the dikes are insubmersible and compacted, farmers feel reasonably sure that they will not be breached as is often the case with their hand-built, non-compacted submersible dikes. The dikes and water control gates assure that the flood can be controlled but they do not assure that the flood will arrive and be sufficient to reach all areas within the diked perimeter.

b. Fish Control By Screens
The fish grills keep large fish out of the perimeters but permit smaller fish to enter. These grow in size within the diked area and are damaging to the rice crop. However, reducing the size of the mesh of the grills has helped cut down on the damage.

c. Selected, Improved Seeds
The selected, improved seed sought from other areas of the country has not yet been shown to be better than local varieties, which have been adapted over many years by farmers who have ascertained that they suit local conditions and enhance farmers' risk minimization strategies.

The local agricultural calendar differs from that recommended in the PP. The farmer seeks to plant at the start of the rains for perhaps four reasons: he exploits part of the rainy season prior to the arrival of the flood; he hopes that the plant will be sufficiently vigorous and developed to grow faster than the rising flood; he hopes they will be vigorous enough to withstand inundation should a gate fail or a dike be breached, at least until repairs can be made. (In this regard, it is said well-developed plants can stand 2-3 days of inundation); and fourthly,

he hopes that the stems will be vigorous enough to withstand the rice-eating fish.

It is said that the plants need 35-45 days to reach this stage of development. The farmer's problem during this period is rainfall. It must come in sufficient quantity to nuture the plants. If it does not, he must replant. To replant he must have additional seed.

In his choice of seed, the farmer will plant late-maturing varieties in the lowest fields and also seed more densely because these places will be attacked by the fish earliest. He may likely sow some earlier varieties so that he can harvest some rice for immediate family consumption before the late varieties are mature. In addition, he will plant a different variety on the higher plots, if any, at his disposal. Sometimes he might even mix seed varieties with different water requirements on the same plant, thus again reducing the risk of total crop loss. The latter techniques would, of course, be anathema to the rice agronomist, particularly if he is trying to measure varietal yield and performance.

Elsewhere, what has been called the "patchwork quilt pattern" of exploitation of small, widely-scattered plots at various levels on the river plains has been mentioned. It was stated, in a brief discussion about land tenure, that this has resulted from decades, if not centuries, of the distribution of use rights and inheritance customs. Yet, it is necessary to recognize the cultivation of non-contiguous parcels of land as simply one other aspect of the farmers' risks minimization strategy. Moreover, the distribution of rights for the exploitation of non-contiguous plots may be evidence as well of a certain, however limited, egalitarianism in the society, for the practice helps to ensure that in years of moderate rainfall and flood, most people, if not everyone, have access to land on which they can hope to harvest something --not all the plots should fail.

One must emphasize that the farmer knows what he is doing. Doubtless, most farmers can identify several varieties by the appearance of the seed. In this regard, we might note an early study of traditional rice farming methods in the delta. The author stated that some farmers had been able to identify as many as 41 different local varieties by mere eyesight alone, something many botanists could not do. We would thus have to take issue with personnel at ARSG who believe that farmers are not sufficiently instructed to be able to differentiate between varieites. On the contrary, we would conclude that local farmers could teach ARSG extension workers more about rice cultivation under conditions they face than the extension workers can teach the farmers. The argument presented by ARSG personnel against local, village management of seed granaries does not hold up.

In fact, it is the ARSG opposition to village seed granaries that puts the agency in such a bad light as far as farmers are concerned.

Earlier in this report it was mentioned that the harvest must be concluded before the weather gets too cold, before the birds arrive in great numbers, and before the planting of sorghum must be accomplished. At the same time, however, the harvest must be somewhat spread out because it is all done by hand and labor is necessarily spread thin. If the rice matures and goes unharvested, the rachis becomes brittle and the seed scatters. Further, no matter how insufficient the rainfall and flood, if the plant services, (assuming the species is Oryza glaberrima, the most traditionally cultivated floating species) its photoperiodicity means that it will flower, however much time has passed since germination, during those few days of specific duration of sunlight. Thus, the farmer must plant different varieties to spread out the harvest sufficiently to allow the limited labor at his disposal to get the harvest in. Then, of course, the rice must be transported, dried, threshed, and perhaps winnowed. The granaries must be stocked and next season's seed set aside. The better part of all this must be accomplished before the farmer puts in his sorghum crop. That the farmer would change his agricultural calendar to adopt the growing methods set forth in the project design is not likely and, indeed, would be an irrational act.

d. Fertilizer

It is clear that Oryza glaberrima does not significantly increase in yield with the application of chemical fertilizer. For Oryza sativa, fertilizer packages can improve yield but probably not more than 20% of seed planted in the ARSG area is of this species. And, as stated earlier, the varieties imported from elsewhere in Mali, even if they are received when needed, have not proved themselves in Gao.

e. Transplanting

At the same time, we would hardly expect farmers to nurse and transplant rice seedlings on all their plots, given their varying soil conditions and levels, and the labor effort and time necessary to do this. This is simply not the most practical thing to do, since it won't significantly increase yields. We cannot, therefore, be surprised by farmers' reluctance to do so. Were the perimeters enclosed by the dikes completely leveled, the methods suggested by the Project Design Team might be useful for farmers to try, but we can safely surmise that under present conditions they simply will not be adopted. Had the project designers been more steeped in local agricultural methods and farmers' strategies and reason for pursuing them, the design could have been more realistic.

f. Fungicides

Farmers do readily perceive the utility of fungicides and want them, but as Brahima Camara's report indicates, the fungicide available does not combat the disease most ravaging. Resistance to efficacious fungicides will not be seen, but we can expect sales of thioral to decrease since farmers may determine that it is not economically beneficial to use it.

One point might be raised here about weeding. Farmers do weed their fields, probably as much as they deem necessary in view of the total risk involved in getting a crop harvested. The wild rice, Oryza perennia, is considered a particularly bothersome weed by agronomists, but because it can sometimes be harvested and eaten when all other varieties fail, farmers may be reluctant to clear it completely from their fields.

Considering what the farmer must contend with, in particular his experience over the recent drought years when no crops were harvested, the uncertainty of rainfall in general, the lay of the land, and so on, we would conclude that the technical package recommended in the project paper was inappropriate for conditions as they existed. The farmer will follow the techniques he knows best, those that in his experience provide the best assurance of harvesting something -- again, those that minimize risks. Further, he will allocate time, labor, and any financial resources cognizant of various risks. The priority goal of the project should have been to help the farmer assure himself of harvest. It should have attempted, initially at least, to enhance his methods rather than change them, for only after he is reasonably assured of a crop over several seasons and has thus built up a security stock of both seed and food grain for consumption will he be amenable to try something new and accept the additional risk he perceives to be inherent in trying methods with which he has not yet had successful and satisfying experience.

2. Dike Construction

Because of the amount of funding provided under the grant agreement, it was ascertained that the entire areas of flood plains which might have been enclosed by insubmersible dikes could not be. As a result the dikes were constructed, essentially following the contours of high ground at the interior of the plains of Gargouna and Tacharane, thus protecting a precisely-defined rice-growing area and some hectarage upon which recession sorghum is grown as the flood recedes. Much good, cultivable land lies outside the dikes, i.e., toward the major bed of the river. Some of this is enclosed by farmers' hand-built dikes. Needless to say, farmers were and are unhappy about this. They would have preferred the insubmersible dikes enclose all possible areas of cultivation at Tacharane and Gargouna. Nonetheless, they understand the cost constraint involved and are perhaps less angry about the dikes' location per se than they are about the fact that they were never consulted in the

design and planning process. In some places where the dike construction took place, a sorghum crop had been planted before construction got started. There crops were destroyed by the construction. Farmers believe that they could have been notified of the timing of the construction. Had this been done and the construction sites indicated, no sorghum would have been planted there. There are, too, those farmers who found the new dikes being built on their farm plots and who therefore lost some of the area they had been accustomed to farming.

People who farm the perimeters at Tacharane and Gargoune admit that some unforeseen benefits have been provided by the new insubmersible dikes. Most important among these is the security the dikes bring. At Tacharane in particular it was stated that farmers' dikes were breached in past years. This year for the first time in their memory this has not occurred. They attribute this to the insubmersible dikes which diminished labor requirements to the extent that all repair effort can now be concentrated on the hand-built, submersible dikes. Accordingly, those got the attention needed and were reconstructed well enough to completely survive the flood. Concomitantly, labor effort during the growing season that had been heretofore directed at the repair of breached dikes was now concentrated on field maintenance after planting. In the past when dikes were breached, labor -- family and other-- was mustered immediately and worked round the clock to repair the breach and prevent plants from drowning. Breaching prior to this year was frequent. Farmers appreciatively note that now they --wives included-- get more more and regular sleep and their energies can be expended on the crop rather than the dikes. The insubmersible dikes, even though they are not as extensive as the farmers would like, are all in all highly praised by the people they serve.

3. Consulting the Beneficiaries: The Cooperative Movement versus Action Riz Sorgho Gao

The rhetoric of project blueprinting inevitably exorts designers to consult those for whom the project is being planned. This seldom happens. Occasionally, a cursory visit is made to a sampling of beneficiaries. This, however, is done not with a view of seeking input into the design, nor with the intent of seeking local grass roots expertise, experience, ideas, or viewpoints. It is done simply to satisfy the design guidelines, hence minimally. Design is still done from the point of view of the donors, or of technocrats who are convinced that what has worked in their own developed countries can work in less developed countries. Study after study has shown that this contributes regularly to dooming projects to failure from their beginning. In this light, we will examine the methods and procedures of the cooperative movement in Gao versus that of Action Riz Sorgho.

Action Riz-Sorgho Gao has been in virtual continuous conflict with the regional cooperative office. To resolve the conflict, ARSG and the Cooperation have held several meetings --November 1978, October 1979, February 1980, and others. ARSG has also submitted a proposal to the National Agricultural office in which is suggested how the two services might collaborate. Note that the cooperation enjoys excellent collaborative relations with the other regional services --functional literacy, livestock, health, waters and forests, hydraulic, and so on. The crux of the problem between ARSG and the cooperation seems to have two aspects -- vulgarization methodology and the distribution of seed, particulary rice seed.

Before discussing the conflict further, we must give a brief description of 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 asks 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 250 FM. The membership at large elects the executive committee. This committee, in concert with the membership, then identifies no less than ten 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, either from the SOMIEX, from merchants, or elsewhere, with products and materials identified by the cooperative members. The store is designed to be a profit-making venture and prices are set accordingly, again by the members.

Selling prices must include a surcharge to cover all costs -- salaries, loss, theft plus an additional percentage which may be distributed yearly to the membership, depending on its decision. Usually, this percentage is reinvested. Funds for the original stock --2,400,000 FM-- plus 1,500,000 FM for building materials to construct the store are donated to the members of the local cooperative by the regional office, whose source of financement is Euro-Action Accord. 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 Cooperative Service 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, as stated earlier, act as a catalyst for other development efforts. The membership, thorugh the executive committee, can ask for further training in functional literacy, training for a health secourist, for help from the forestry service to start a village tree nursery, and so on. It is worthwhile to note that the Regional Cooperative has helped 36 local cooperatives get started over the past five years. Each of the 36 has created a village store and only 2 of the 36 have failed, for extraordinary reasons. These two, at Kidal and Ansongo, have been restarted. Four additional points are worth noting. Where some of the village stores have been started, local merchants who were alledgedly gouging the local population have been forced out of business. In these cases, it was stated that local merchants would buy food grains at low prices after the harvest when farmers need money and resell the grains later, often to many of the same farmers, at a 200% profit. The village cooperative stores buy grain from their members at official prices and resell, only to local villagers, at a cost 20% above purchase price. Thus, villagers not only acquire seed security but also have reasonably priced food grains available to them when they need it. Secondly, some stores are so well organized that their managers travel as far as northern Nigeria to purchase stock for their stores. One in particular at Bourem has been so successful that it has increased its operating capital to 8,000,000 FM. It will become completely independent this year. Finally, each store must recover its initial operating capital within three years of opening.

Returning to the conflict between ARSG and the Regional Cooperation, we must comment first on the differing methods of the two agencies. The Cooperation believes that the thrust for development must come from the people. The people --farmers, livestock owners, fishermen-- must ~~define their~~ needs, problems, solutions to problems, and possible ways to implement solutions. ARSG has felt, to the contrary, that it has already come up with solutions to increase agricultural production and that farmers should be obliged to follow the advice of the ARSG technicians. Likewise, the Cooperation believes that farmers should control and manage development inputs while ARSG feels its personnel should exercise control and management over inputs.

The provision of rice seed to farmers is another source of dissention between the two agencies. We must mention once again that having enough seed to plant when he needs it is an important concern of the farmer. This means having a sufficient amount to replant, should the first plants die from lack of moisture. Helping farmers procure rice is a concern of both agencies. ARSG seeks seed from the state reproduction farm at Babougou, from Operation Riz-Segou, or from Operation Riz-Mopti. The distance of those

locations from Gao presents the problem of timely liaison, coordintion, and transport. This past growing season, for example, ARSG finally received its seed orders in August, too late to distribute to farmers. ARSG does distribute such selected seed, when it is available, to farmers on credit for the duration of the growing season. For each 100 kilos distributed on credit, ARSG demands 115 kilos of harvested rice. Only about 20% of the farmers in the ARSG area are using selected seed. Reasons for this low figure have been untimely availability and the experience of yields lower than those of local varieties. The latter is explained by the increased labor intensity needed to achieve higher yields or the inappropriateness of the selected seed for the Gao area. The rate of recovery of seed by ARSG over the last five seasons is about 15% (see Camara report annexed).

The Cooperation helps each local cooperative to seed up a seed granary in the village. From this seed granary, overseen by the local cooperative administration but managed by a designated member of the cooperative, members may borrow rice seed on credit. At the end of the harvest, for each 100 kilos given out on credit, the farmer is asked to pay back 150 kilos. Sagou Adama Ouologuem, regional director of the Cooperation when the evaluation team was at Gao, stated that each local cooperative recovers almost 100% of its loans. The reasons for this high repayment rate, he says, 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 50% gross profit made on each loan ultimately benefits the members of the cooperative, and, perhaps most important, the farmers no longer need depend on an outside agency, gouvernmental or other, to provide seed when they need it. The village seed granaries have made them self-sufficient.

These village seed granaries would seem to be a good idea. What then is the conflict between the Cooperation and ARSG? The reasons are these:

- ARSG believes that rural farmers do not have the capacity and are not sufficiently advanced technically to manage village seed granaries;
- ARSG feels that different varieties are mixed together in the village seed granaries since farmers are not aware of the technical importance of keeping them separate;
- Since ARSG and Cooperation policies differ in the matter of seed distribution and reimbursement, ARSG will not adopt the Cooperation methods;
- The text of the project agreement with USAID does not allow ARSG to set up village granaries either by simply giving out selected seed or by exchanging it for other varieties;

- There must be a firm delineation of geographical areas in which the two agencies work. Thus, the Cooperation must not work in any locations encadreured by ARSG.

Farmers interviewd by the evaluation team were aware of the ARSG arguments and did not agree with them. They are also aware of the differences between varieties and stated that it serves their interests to isolate different varieties since whatever might be repaid after one season could well be used the following year. They naturally want to know what they plant because they utilize different varieties in different locations, governed mainly by soil conditions and land level. The evaluation team visited one cooperative village granary and saw sacks clearly labelled with the names of the single variety contained in each sack.

ARSG personnel feel they are working at a disadvantage vis-a-vis the Cooperative because their financing includes no money to provide start-up funds to establish village stores/granaries. In this regard, they view the start-up funds given out by the Cooperative as out and out gifts. Farmers in ARSG villages are very knowledgable about the work of the Cooperative and the benefits that can be derived from setting up a local membership --notably the village store/granary. They also know that ARSG has attempted to prevent cooperatives from being set up where ARSG works and are resentful of this. In many villages along the Bourem-Ansongo corridor, therefore, ARSG is perceived as being opposed to the interest of the rural population.

Before leaving this discussion, additional activities of the cooperative movement must be listed. Besides setting up village stores and seed granaries, these include:

- technical support for crop diversification during the dry season, i.e., vegetable production;
- development of root crops and fruit tree plantation;
- organization of cooperative work groups for dike repair;
- provision of various types of small equipment to fishermen;
- the organization and start-up of a pirogue construction workshop;
- small hydro-agricultural works, i.e., dike openings, fish grills;
- teaching range management principles;
- setting up village nurseries for reforestation;
- training village health workers;
- training village para-veterinarians.

The success of the cooperative movement in the Sixth and Seventh Rgions is remarkable. The reason seems simple: The intended beneficiaries are completely involved in planning and management. They govern their own affairs.

IV. SUMMARY AND RECOMMENDATIONS

A. 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 of 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 that USAID funding to a follow-on effort of the Action Riz-Sorgho Project be continued only with a revamping and redefining of the responsibilities of the present Action Riz-Sorgho administration. It is unclear at this time whether this new organizational structure will continue to be called "Action Riz Sorgho" or whether the organization's proposed functions may be encompassed in an entity of another name (for example a regional GRM agricultural office closely connected with the Institut de l'Economie Rural (I.E.R.) -- and hereafter referred to as the Agricultural Office). In any event, this organization should assume the role of helping farmers assure and increase crop production via traditional methods as practical in the Gao Region. This office's role should be one of supporting research, providing technical counsel through extension, training of extension agents and executing demonstrations which support extension advice. Extension agents of this office should distribute no seed, no fertilizers, no fungicides, no herbicides, no poison. They should not administer credit, nor should 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 Ag office 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, the Ag office 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 the Agricultural Office/ARS Replacement

In line with the reorientation discussed under recommendation (1), the evaluation team sees the duties of the Ag office 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 -- Personnel of the AG Office should have a sufficient skill level. The evaluation team believes that most of the material and human resources necessary for improving Ag Office performance as opposed to the ARSG will be found in Mali; a combination of IPRG, the rice agronomist Dat Van Tran, the Ag Office heads of training and extension, farmers' knowledge of local conditions, local engineering expertise with water control and dike gates, the DECAMA pump repair team, and the cooperative movement's experience with grass roots organization.

The team believes that the director of the Agricultural Office 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

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 entree 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, Ag Office 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 pursuaded 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 emphasis that the best avenue to collaboration with farmers will be through the cooperative under their control.

(e) Administration/Finance -- the administrative section of the Ag Office 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 the Ag Office 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-

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 ration. Note that the office limit of twenty includes everyone --chauffers, janitors, watchmen, in short, all office employees. Research station employees must be limited to 10 people, again including everyone. Thus the Ag Office 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 thorugh 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.

3. The Cooperative Movement:
The reorientation of the Ag Office from ARSG will leave a vacuum in the provision of ag inputs. The evaluation team recommends that the Regional Cooperation be asked to fill that vacuum by assisting farmers to form local cooperatives, and to create and manage local cooperative stores.

Previous discussion has described the methods and procedures of the cooperative movement. Much of its success in the Sixth and Seventh Regions has resulted from two basic factors: farmers themselves define and manage their own development needs, and the creation of local cooperative stores. The former factor has long term ramifications for economic development, the latter brings immediate and tangible benefits to villagers.

The evaluation team suggests USAID provision of direct financing to Euro-Action Accord for the creation of stores and purchase of initial stock and equipment. As EAA does, we would consider this amount of financing as an initial operating grant. No reimbursement would be expected but the cooperative would be asked to set prices to cover all operating expenses plus a small profit percentage. Thus would a rolling fund for reprovisioning and financement for other sorts of development interventions be constituted.

We would expect the cooperative movement in the Gao Region to assist perhaps five villages per year to set up cooperatives. Since EAA and the Cooperation already exist in a number of ARSG villages, the start-up of five per year should mean that the movement will touch the entire area presently encompassing ARSG during Phase II.

An important aspect of the cooperative store, as indicated earlier in this report, is the constitution therein of a seed stock. Cognizant of the ARSG technical concerns about the mixing of different seed varieties, we view the counsel of the extension agent as necessary to increase farmer awareness of the importance of keeping varieties separate and distinct.

Each cooperative store should purchase 10 water pumps and 1000 meters of hose. These pumps will be rented to farmers at an hourly or daily fee sufficiently high to assure their amortization over three years. The store must also stock several drums of fuel and enough motor oil for the pumps. Moreover, each store should have a set of

tools for pump repair and a cooperative member designated by the general membership as the person in charge of the pumps. These pumps, of course, should be mounted on wheels for ease of movement from store to field. Collective purchase of the pumps should be executed by the Regional Cooperative Office for distribution to local cocperatives. Purchase price would be financed by USAID.

At two locations, Tacharane and Bara, the evaluation team recommends that a wheeled-tractor with backhoe and bucket-loader attachment be stationed. These machines would be controlled and managed by the local cooperative membership. We suggest Tacharane because insubmersible dikes have been completed there and Bara because such improvement has not yet occured.

The tractors will have to have a driver/mechanic assigned as the person responsible for the machine. This person should be appointed by the cooperative membership. Training the designate will be done by the Catholic Mission in Gao in conjunction with Public Works and the Dutch mechanic at the regional cooperation office.

Provision of these tractors will be experimental. The object will be three-fold: (a) to learn whether such equipment can be cooperatively used;(b) to see whether such equipment can be effectively maintained and economically utilized if control of the machine is exercised by the cooperatives whose members have a direct interest in its long life and proper use;(c) to learn what effect a reduction in heavy physical labor --in this case dike construction--will have on crop production and human health problems. It is intended that the machines, with backhoe and front-loader accessories be used to assist with dike construction and repair, and canal excavation. The machines are not intended to replace human labor but to reduce it with machine power.

The machines will have to be rented--by individuals, by families, by group of farmers having contiguous fields. Rental fee should be high enough, according to projected use, to assure the equipment amortization over five years as well as operating and maintenance expenses. The recommendation assumes that the cooperatives formed at Tacharane and Bara may want to rent their machines to farmers at other locations. The risk in this experiment is well understood. However, the experiment seems will worth undertaking to learn what people, who themselves control their own inputs, can achieve in production in this difficult and harsh geographic area.

Certainly, all of our proposals need to be examined. Their feasibility needs to be discussed with ARSG officials, rural peoples, cooperation personnel, and ministry officials. Assuming such to be a prerequisite, we nevertheless estimate the financing of village cooperative stores to amount to the following:

(a) Construction Materials: 2,500,000 MF
Cement, roofing, iron, nails, shelving, lock, tools:
for construction of an office, storeroom for consumptive items, storeroom for

pumps and hoses, hangar for tractor, granary/storeroom	
(b) Store Consumables:	2,500,000 MF
(c) Seed Granary	500,000 MF
(d) Pumps, hoses, fertilizer	7,000,000 MF
(e) Tractor/tools/parts/fuel/oil	12,000,000 MF

USAID's total amount of financing for the cooperative, assuming the EuroAction Accord can finance the training by DRAFLA, would amount to $750,000 or about $30,000 per village cooperative over a period of five years ($1=500MF) at the rate of five villages per year. The financing needed for the five year period for support of ARSG's activities remain to be precisely calculated, but should not surpass $250,000 per year, including foreign technical assistance.

One further aspect of the cooperative movement needs discussion here. At this time, no significant cash contribution for the start-up of the described activities has been sought by the cooperative movement. However, the evaluation team wishes to ask EuroAction Accord to consider making a 5000 MF "cotisation" requisite for membership in local cooperatives where $30,000 financing is provided by USAID. The demand for a requisite "cotisation" carries the risk of possibly excluding very poor families from membership in the cooperatives. On the other hand, clearly perceived benefits might encourage even very poor farmers to somehow come up with the "cotisation", particularly if it is seen as an investment rather than a contribution. Moreover, a minimum membership requirement of 100 would raise 500,000 MF, a not inconsiderable sum which would, if pledged, indicate keen interest on the part of farmers willing to pledge that amount and interact cooperatively.

The broad lines of the evaluation and the team's recommendations have been drawn. If found acceptable by USAID personnel, they need to be presented to cooperation and ARSG officials for further discussion, precision of detail, and final agreement on the plan and its financing, collaboration between various government services, broaching the ideas to farmers.

4. FEASIBILITY OF RECOMMENDATIONS

The evaluation team believes its recommendations to be feasible. We will take a brief recapitulatory look at why:

--Administrative/Financial: With the load reduced, i.e., the Ag Office will not have to worry about providing inputs and recovering loans, it should be even more efficient. However, project manager and controller's office will have to set up budgeting, disbursement,

accounting procedures, teach them to Ag Office staff if necessary, and thereafter require that they be followed.

--Technical: Concentrating the efforts on research, extension, and demonstration in concert with the knowledge, experience, and concerns of local farmers is a step-by-step approach. The primary purpose of technical counsel will be to help farmers be assured of a harvest, and next to improve techniques, thirdly to suggest changing or replacing techniques. No suggested change in traditional techniques is foreseen during this Phase II of consolidation. Such can only occur when the applied research has produced results which may constitute a technical package worthy of extension to the farmers, that is, a package better than their own. The research will accordingly have to focus on many aspects of crop production--including labor availability; requirements, return on investment, alternative avenues of investment of time, labor, finances and not simply the agronomic ones. Much crop assurance will come from the availability of diesel-fueled water pumps which will help farmers nurture young plants during periods of slack rainfall. The proposal for provision of tractors with backhoes and front-loaders is admittedly risky in many respects but is intended as experimental in nature. Assuring the ability to keep the water pumps running is less risky, since both the SECAMA and the regional cooperation have pump repair units who can train the pumpist selected by each cooperative.

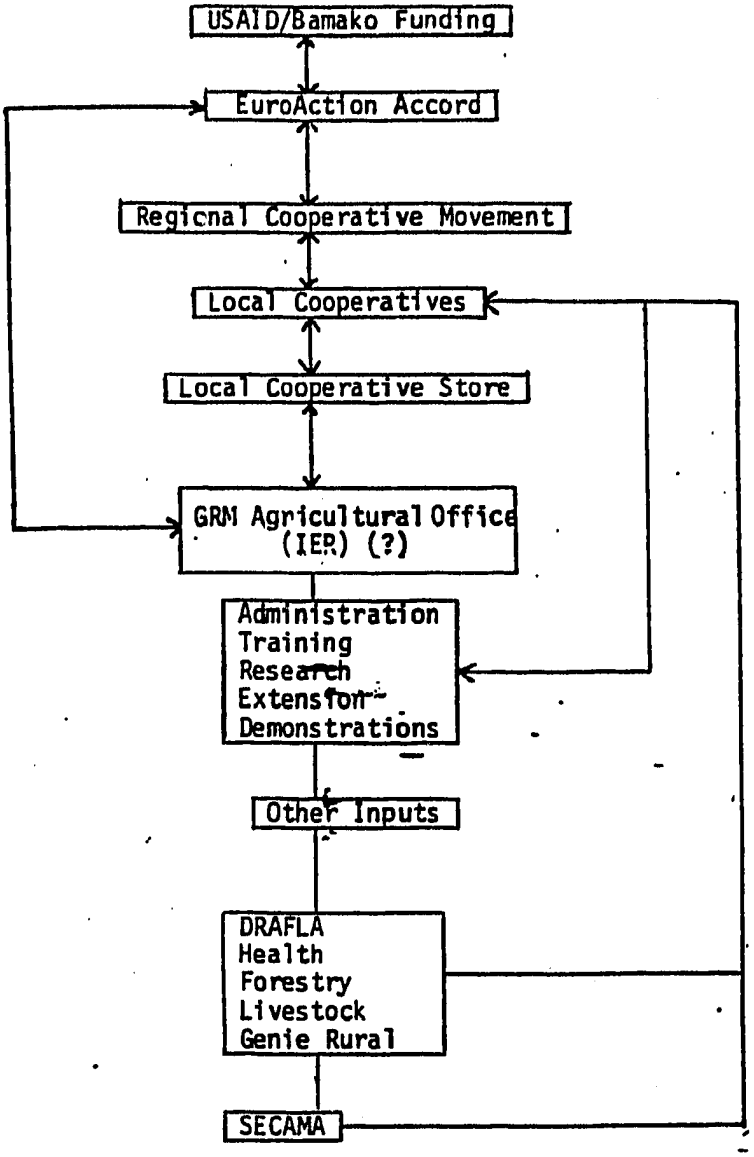
--Social: Because in the reorientation of the project, farmers will be involved in a development dialogue and be able to exert greater control over their own development and destiny, the evaluation team considers its recommendations socially feasible. Indeed, in our scheme, little will happen unless farmers want it to. The mutual respect and confidence that should develop between project personnel and farmers can only encourage expanded crop production through collaboration. Creation of local cooperative stores will be an important local achievement, bringing tangible benefits which will also encourage agricultural production. Finally, the recommendations seek to make more farmers more independent, given them more power, and reduce their dependency on government agencies.

--Economic: The evaluation team sees not only increased economic activity, but substantial benefits derived by farm families. These will consist of better rice production with greater assurance of adequat harvests, thanks to the pumps, and reduced commodity and equipment costs achieved through the opening of local cooperative stores. The added value of the increase in overall rice production alone, projected to be at least 3,000 tons by the evaluators, will have a significant effect on farm family income and nutrition.

--Logistical: The remote locations of Gao vis-a-vis Bamako presents logistical difficulties for delivery of project commodities which must be purchased. For U.S.-made or other foreign commodities, the evaluation team suggests shipment through the port of Lome via Niamey directly to Gao. By-passing Bamako--as well as the ports of Dakar and Abidjan--should result in quicker delivery of commodities.

We recommend that American equipment be ordered through local distributors. This relates only to pumps and backhoes. Another possibility may be to purchase French manufactured items where the French concerns are subsidiaries of American companies.

To further minimize logistical problems, we have left the decisions for most provisioning to local cooperatives (except for pumps and tractors which will usually be able to procure much more efficiently than GRM agencies.


USAID/Bamako Funding
EuroAction Accord
Regional Cooperative Movement
Local Cooperatives
Local Cooperative Store
GRM Agricultural Office (IER) (?)
Administration
Training
Research
Extension
Demonstrations
Other Inputs
DRAFLA
Health
Forestry
Livestock
Genie Rural
SECAMA

The schema is thus as follows:

(a) Action Riz-Sorgho Gao
- Administration
- Training
- Research
- Extension
- Demonstrations

(b) EuroAction Accord
- Local Cooperatives
- Cooperative Stores with
  - primary goods
    - pumps and hoses
    - seed
    - fertilizers
    - poison
    - fungicides
    - mechanics' tools
    - fuel
    - oil

Fabruary 4, 1981

ADO/CROPS, Brahima Camara

Evaluation of the Activities of Action Riz-Sorgho regarding Agronomic Practices, Water Control and Management - Project 688-0206

THRU : ADO/CROPS, Mr. Kurt Fuller
A/ADO/CROPS, Ms. Gail Shands

Note : My first comment is that the evaluation team should have included a senior rice agronomist with agronomic expertise and experience in developing, testing, introducing and evaluating the technical inputs to small farm systems.

I. Perhaps there would be no need to take up the definition of this project once more, but I think it is imperative to remind everyone of the reasons which motivated its creation.

The region of Gao has suffered from the drought that started in 1968. According to the data gathered, one can only envisage irrigated or post-flood crops profiting from the water of the Niger river, the only river in the area. The proposed improvements aimed at building insubmersible dikes and digging of canals which would help in regulating the inception of the submersion in the plains and in protecting the rice plant against fish. The expected result is increased production through better yields and large acreage.

Toward these objectives, the project has included four major interventions:

1. Improvement of rice output on an area of 5,000 ha, through the introduction of improved and treated seeds, better agricultural practices and the reinforcing of existing submersible dikes by manpower, and the installation of water gates and fish screens.

2. Improvement of rice production on a supplementary area of 5,000 ha through the construction of insubmersible dikes with earth moving machinery, and installation of water gates and fish screens.

3. Improvement of sorghum outpu on 3,300 ha through the treatment of seeds, and

4. Establishing a research center to test new varieties, agricultural practices and fertilizer doses.

The measures of project achievement are: annual cereal production in the Gao area increased by 3,750 MT/year; and improved varieties and practices were introduced to 10,000 farmers. The PP estimated production of all cereals within the area served by ARS to be 10,000 tons.

II. Progress towards achieving these goals:

RICE - Area Cultivated (in hectares)

Year	Total Acreage		Improved Seeds		Local Seeds	
	Sown	Harvested	Sown	Harvested	Sown	Harvested
76-77	-	6261	1245	1095	-	5166
77-78	-	6950	3500	1799	-	5151
78-79	8890	6688	1198	805	7692	5883
79-80	8060	2105	1213	713	6747	1392
80-81	7142	-	1375	-	5167	-

RICE - Production (in MT, based on area harvested)

	Total Production	Selected Seeds	Local Seeds
76-77	4295 paddy	678	3617
77-78	4776	1160	3616
78-79	6173	820	5353
79-80	2828	964	1814

RICE - Yield (in kg)

	All Varieties	Selected Varieties	Local Varieties
76-77	686	619	700
77-78	687	644	701
78-79	923	1018	910
79-80	1338	1353	1324

Observations:

1. Acreage:

Using 1976/77 campaign as a base year, the acreage for local variety rice decreased by 0.29% in 1977/78, and by 76.33% in 79/80. Unfortunately, this reduction is not due to giving up local varieties in favor of selected varieties, but only to the low frequency and bad distribution of rainfall.

For the same periods, the acreage in selected varieties increased by 64.29% in 1977/78 compared to the first campaign of 1976/77, but decreased significantly by 55.25% in 1977/78 and 11.42% the following year.

These figures depend on the timely and adequate supply of seeds. The 1977/78 campaign proved to be good thanks to an adequate supply of seeds from the seed producing centers and, consequently, the acreage increased. On the other hand, in the following year, the farmers ran out of seed. ARS which was their only hope to get seeds, did not have

sufficient means to provide it to them.

2. Yield:
Yield has increased both for local and selected varieties. The progressive increases are as follows:

Local varieties: Using 1976-77 as a base year, the yield remains unchanged in 77/78, but increased progressively by 30% in 1978-79 and by 89% in 1979/80 thanks to their hardiness.

Selected varieties: The yields in 77/78 and 78/79 were lower than those of the local varieties due to their inadaptability to the environment and also because of bad cultural practices and poorly trained extension agents. The selected varieties had higher yields as compared to local ones in the third campaign (78/79) due to improved technical practices, more experience gained by extension agents, dike construction allowing the control of the flood, and watering of seedlings with motor pumps.

The decrease in 78/79 and 79/80 is due to bad production in these years. It seems that the figures given by ARS are lower than they were in reality (because notdistinction is made of farmers who use their own seeds which can be selected seed as well). Anyway, if we compare the total number of supervised farmers and the farmers using selected seeds, it becomes evident that the ARS project is far from reaching the goal assigned in the PP.

Year	No. of Farmers using seledted Seeds	No. of Farmers supervised
76-77	1581	7141
77-78	2947	8141
78-79	2083	11539
79-80	1425	7899
80-81	1858 (Bara not incl.)	6400 (incl. 3481 for sorghum)

In this table, the only correct figure concerning the number of farmers supervised is the last one (which represents 64% of the project goal). The prior figures had been doubled, i.e. counting 2 for a single farmer who cultivated both sorghum and rice).

Recuperation of seeds:

There is a 15% interest charge to the farmer for seed for one campaign. The recuperation of these seeds proved very poor, as shown by the table below:

Year	Seeds in Tons	Recuperation in Tons
76-77	94.500	-
77-78	135.500	20.566
78-79	89.100	50.769
79-80	108.400	5.281
80-81	108.740	-

Situation of Other Inputs (Fungicide and Fertilizer)

Year	Phosdrin (l)	Thioral (boxes)	HCH (kg)	Urea (kg)
76-77	-	2677	-	880
77-78	-	-	-	6230
78-79	-	6822	12,140	5100
79-80	5	9205	2,595	2105
80-81	-	21701	5,656	1959

The use of fertilizer is experimental because the farmer does not exactly know how much acreage will remain definitely productive, he does not as for fertilizer.

SORGHUM

Year	Area Sown (ha)	Area harvested (ha)	Yield (kg)	Production (tons)
76-77	-	500	420	210
77-78	-	1803	469	847
78-79	1953	1595	512	815
79-80	3629	1958	455	851
80-81	3676	3374	444	1932

It was not possible to determine the area treated versus the area not treated. The only figure available is the amount of fungicide utilized. Though this amount is for both rice and sorghum, it shows how widely this technical package has been accepted.

The analysis shows that an increase of 136%, 243% and 710% was reached respectively in 78/79, 79/80 and 80/81 compared to the base year 76/77.

The acreage increased progressively by 260% in 77/78, 218% in 78/79, 291% in 79/80 and by 574% in 80/81.

This last figure has reached the project goal (3300 ha of sorghum). But unfortunately, the yield remained almost unchanged since the first campaign. The outbreak of Aphis sorghii (plant louse) with a subsequent decrease in yield as of the 78/79 campaign illustrates that the fungicides used in the area are only specifically against black rust.

The increase in production comes from the area made available for cultivation by the dike construction, i.e. the area planted to sorghum was greater than for rice in Tacharane. Hectarage cultivated is linked with timing and the extent of the flood and flood recession - which is now controlled due to the dikes.

Dike Constructionsand Research Center

The insubmersible dike construction began in April 1979. Presently, two plains are protected by 17 km of dikes, 1300 ha in Tacharane and 678 ha in Gargouna. This total of approximately 2000 ha represents 40% of the target set in the PP. That of improving rice production on an area of 5000 ha through introduction of selected and treated varieties of rice seeds and reparation of the existing submersible dikes with hand labor has been initiated. Reparation of existing dikes by hand has taken place in an area that will improve rice production for about 3000 ha. With the delay in dike construction and digging of canals (2 years behind schedule), it is not realistic to expect that the project would reach its targets. These canals are very important to correct the irrigation system, particularly in Tacharane. Logically, water should enter at the higher ground level and flow down to the fields by gravity, however, the system installed at that site is exactly the reverse.

The remaining fourth intervention, the installation of the field research station, was undertaken last year, almost four years behind schedule according to the implementation plan of the PP.

III. DISCUSSION

In hindsight, some observations can be made, namely:

- ARS has suffered from insufficient funding and poorly timed funding.
- There was no separation of credit funds and operating funds.
- The dike construction has experienced a serious delay. The dikes are not protecting the right part of the flood plains, especially in Gargouna).
- The working relationship between ARS and Génie Rural or OTER has been less than effective.
- The research center has just begun operations, almost at the end of the PACD.
- One two trainees have completed an 11-week course in agricultural extension.
- Even though these trainees are not in a position to conduct training of the remaining extension agents, technical assistance needed to support the programs has not been on the list of project priorities.

- The work load (rate of production technicians to farmers supervised) was marked by the availability of one a small number of "agents de base" who had to execute the majority of extension work. These agents are the ones who actually work with the farmers, showing them the improved cultural practices. Unfortunately, their number is too low to effectively disseminate information and thereby impedes extension efforts.

- The technical package offered is very poor (i.e. the fungicide used for seed treatment is not adjusted to the conditions existing; absence of plows; unsuitable improved varieties).

- The project is supporting uneconomical journeys to and from Mopti-Segou to supply farmers with improved seeds, and has never been able to get all of the seeds needed from any single source (Opération Riz Ségou, Opération Riz Mopti, or the multiplication farm at Babougou).

IV. Recommendations

In view of all of these problems it appears that the beneficiaries have no voice in project decisions and no leverage in case they may judge decisions or actions to be unwise. AID must make a concerted effort to improve communication and give full powers to the farmers in the decision making.

With the delays in implementing the work and the absence of canals which will distribute the water in the plains, it is not realistic to expect the project to reach its targets on time. A third dike inside the plain and several canals are needed to correct the error in the irrigation system installed in Tacharane.

ARS should take advantage of the proximity of the water table by digging one or two wells along the edge of the field and grow seedlings (as is the case of the wheat producers in Diré).

In conclusion, AID on timely and project specific work plans.

Technical assistance is very important in developing opportunities for production increase, for devising techniques and evaluating them in terms of usefulness to the farmer. This is necessary as the level of the technical package which directly impinges upon both total production and productivity is very low.

Seed treatment - though it is the most widely accepted of the recommended practices, the project has not yet been able to provide a large range of fungicide to protect the crops against pests.

Use of plow - As the rate of this practice is not significant, training and counselling by the Direction de Machinisme Agricole should be emphasized as well as the creation of an animal traction training center.

As for the use of improved varieties, it must be noted that the selected seed varieties have growth cycles which are longer than those of the traditional varieties, and inspite of their genetic potential, are not well suited to the area because the long cycle increases the chances of loss to birds and insects. It is, therefore, necessary to establish a seed multiplication farm in which selection from local varieties is made which then might prove to be superior to the local varieties in general use now.

The receptivity of the farmers to the introduction of new improved practices depends on their having the needed capital for acquiring the equipment. But in most cases (e.g. the last amendment), the credit funds have been used for meeting operating expenses of ARS. I propose that in the future AID will make sure that a credit system be implemented as foreseen in the amendment.

cc: ADO
DIR/DD
PROG

ANNEX

Further Technical Information on Action Riz-Sorgho /Gao

The northern part of the zone Gao-Bourem comprises an area of 3000 ha exploitable without insubmersible dikes in comparison to the area between Ansongo and Gao which pomprises around 6000 ha in the Hausa plain alone. Some production data, added to the receptivity and loan recuperation problems led me to propose that ARS concentrate its man-power and material in the southern zone.

Comparison of Production:

	Southern Zone		Northern Zone	
	Gargouna	Tacharane	Forgho	Moudakane
1978/79				
RICE				
-Area sown (ha)	1009	663	1415	1288
-Area harvested (ha)	937	649	529	1171
-Yield (kg)	1281	645	1236	904
-Production (tons)	1201	419	654	1059
-Transplantation (ha)	42	60	149	487
1979/80				
-Area sown (ha)	1030	713	1644	1354
-Area harvested (ha)	247	297	32	305
-Yield (kg)	1392	1946	714	920
Production (tons)	344	579	22	280
-Transplantation (ha)	18	100	111	517
1978/79à				
SORGHUM				
-Area transplanted (ha)	90	420	148	162
-Area harvested (ha)	1	410	148	162
- Yield (kg)	266	582	331	308
-Production (tons)	0.266	239	49	50
1979/80				
-Area transplanted (ha)	136	700	516	384
-Area harvested (ha)	98	339	401	85
- Yield (kg)	371	886	188	32
-Production (tons)	369	300	75	2

Following are observations and information I gathered in Niger which might be useful in planning for ARS:

Relationship between the "GMP" and other services:

These services are: UNCC (Union Nationale de Crédit et de Coopération)
CA (Centrale d'Approvisionnement)
CNCA (Caisse Nationale de Crédit Agricole)
ONAHA (Office National des Aménagements Hydro-Agricoles)

The development policy is as follows:

The State manages the lands for free utilization by farmers.

Land within the irrigation system is entrusted to the ONAHA which can be likened to our rural development organizations. This office not only supervises the construction works but also assures extension of agricultural practices thanks to the existence of its infrastructure and development divisions. It serves also as the intermediary between the farmers and the other organizations mentionad above, as follows:

- The UNCC which deals with
  - the organization of farmers into cooperatives
  - the cooperative promotion and training
  - the procurement of agricultural inputs through the CA (Centrale d'Approvisionnement).
- The CNCA is a bank subsidized by the state. When a cooperative is formed, the regional office of the ONAHA writes to the CNCA to open a credit account for the cooperative.

The cooperative expreses its needs for one agricultural campaign by using purchase orders countersigned by the Regional Office of the ONAHA. All orders duly executed by the prestdent of the cooperative and the director of the perimeter (ONAHA) are collected centrally and sent to the UNCC which delivers and sends an invoice to the regional office of the ONAHA. After verification of the services rendered, the regional director of the perimeter (ONAHA) issues a check signed and countersigned by the presidentoof the cooperative. This check is cashed directly by the supplier to the CNCA where a credit has been established in the name of the cooperative.

The recuperation of loans is then made by the bank with an interest charge which is very low, ranging from 6 to 12Z.

The expression of needs in form of purchase orders serves to calculate the fees, but on the average these fees are in the oder of 50,000 F CFA.

In summary, the role of the ONAHA consists of the following:

-assurance because of complete control of the water (6,000,000 F CFA to 3,300,000 F CFA per hectare)

- extension agents (2 to 33 agents per perimeter)
- organization of farmers into cooperatives
- training of agents and self-teaching of farmers (of techniques passed on through the cooperatives).

Other information gathered with respect to management:

The distribution of land: - 0,15 ha per user
- priority is given to former owners after which come the neighboring farmers.

The usage contract between the ONAHA and the farmers, as well as the management conditions between the government and ONAHA are as yet in the planning stage.

Rotation - There is no rotation (rice is planted upon rice), the following varieties are employed IR 15/29, IR 122, IR 15, Chinese varieties and de Gaula (floating rice variety for low fields).

Basic seeds and nursery: The farmers are not allowed to have their own nurseries (seed beds). All the surface is obligatorily transplanted to rice.

Mechanization - Labor: At first tractors were used which are now replaced by animal traction because of the high cost of the tractor rental: 11,000 F CFA/ha as compared to animal traction (oxen) - 8,000 F CFA.

The price of the plow is subsidized: 8000 F CFA.

Harvest: A thresher is amortized in two years (the price is 20,000 F CFA).

Irrigation: made with the help of an electric pump; example - for 45 ha, one pump of about 30 CV with a delivery of 1500 m^3/hr is installed.

Types of perimeters in use:

There are only two types in existence - the basin type of which the total manometric height is about 6 m - and the terrace type of which the total manometric height is about 20 m.

Paddy

Ger: Rendement moyen /hec/ 4000 kg > /2 x year
Prix officiel 55 CFA/kg

Recovery of Seed Loan for the last Campaign:

Southern Part		Northern Part	
Tacharane	1920 kg	Moudakane	130 kg
Gargouna	770 kg	Forgho	104 kg
Anaongo	604 kg		
Bara	1853 kg		

Gao 60 kg

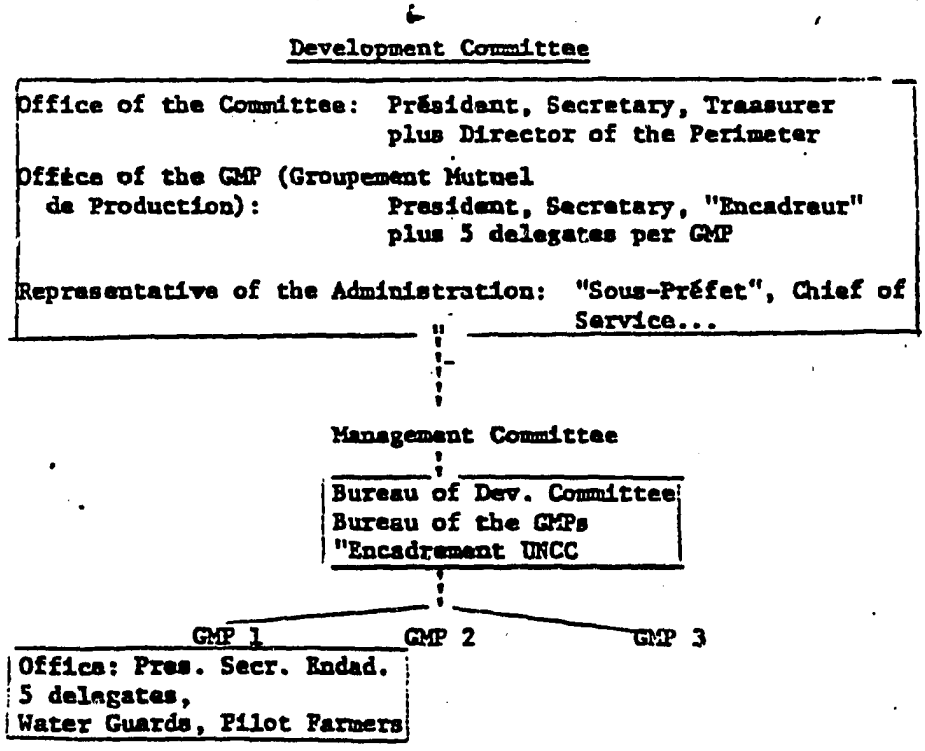
Some important points have to be noted:

- the yield of rice in the southern part has been increasing or at least remained constant during the last two years (in Gargouna and Tacharane there is an increase of 963 versus 1669 kg, in Moudakane and Forgho the yield decreased from 1070 to 817 kg).

  The same observations was noticed for sorghum as well:
  in Gargouna and Tacharane the average yield increased from 424 to 628 kg;
  in Forgho and Moudakane the yield decreased from 319 to 110 kg.

- The conceptualization of the approach.

As have most "Opérations", ARS has also adopted the "pilot farmer approach" as a means of reaching the farming population. The following chart shows the organization set up to reach the farmers around diked areas which I visited in Niger:



TECHNICAL EVALUATION
PROJECT ACTION RIZ-SORGHO (688-11-130-206)
(Draft from Partial Notes)

I. The Project Design

USAID funding of the Action Rix-Sorgho project was based on the following investment equation (see Logical Framework, p.3 of PP):

Inputs	=	Outputs
1) Capital a) Dike and gate construction b) Improved seed and seed protection c) Hand tool purchase d) Field Research Station 2) Technical a) Staffing b) Admin. Support c) Training d) Demonstration		1) 5000 HA of rice, partially protected with yields of 900 KG/HA 2) 5000 HA of rice, completely protected with yields of 1300 KH/HA 3) 3300 HA of sorghum with yields of 600 KG/HA 4) Annual village demonstrations of techniques

This equation was faulty both in its conception and its application.

First of all, this mix of capital and human investment simply will not affect the substantial increases in cereal production desired. Dikes and control gates can ameliorate only one extreme of the flood-drought cycle. By moderating the rate of the water's rise and fall, dikes and gates can assure moisture to both crops over a longer and later period of time than the precipitous rise and fall of the river normally allows

Protection from Rizophage fish is also improved. However, only small increases in yields and acreage can be expected since the dikes and gates do not assure moisture during early rice and later sorghum growth.

With such sparse (300 mm) and sporadic annual rainfall, farmers must have the ability to guarantee moisture to seedlings as well as transplants for strong first growth prior to flooding. The scenario described in the project paper (The farmer "....will be able to shift entirely from broadcasting to transplanting with rising water", pg. 7) is not feasible. In most cases, weak transplants simply cannot take root and begin growth with rising waters in the absence of rain. Nor can farmers delay planting by the six-week period suggested, extending harvest well into the dry season when grain-eating birds are flocking along the river's verdant banks.

Improved seed and seed protection have been responsible for a small increase in rice and sorghum yields. Testing and selecting new varieties through field research will undoubtedly be productive by augmenting this increase. However, even the highest yielding varieties and best protected seeds will fail for lack of a reliable system of water management to insure moisture during the most critical growth periods.

Although sufficially appropriate, the human, "technical" input was also inadequate to achieve higher production. Farmers need the primary technical services of small-scale construction assistance and pumping technology. They stress these as fundamental needs (see reports by Walker, 1978 and Putnam, 1978). Such services can be cost-effectively and reimbursably provided through a works section and associated credit scheme. The success of other techniques will depend on the introduction of basic water management on these plains. The project paper, in listing an agronomist with a water resources background, an irrigation engineer, and agricultural and construction techniciansons the Project Staff (pp. 22 and 24), grossly exaggerates professional titles. "Excellent performance..... exceptional ability... blend of talents..... fully adequate...." are not staff descriptions, but blind overstatements. Neither the Project Staff nor the Project Management are technically trained or focused enough to meet the needs of the agricultural situation.

II. The Project

Personnel: The ARS Staff is basically unchanged since last year. However, the former Assistant Director has become Director (having directed the project and interim often in the past). As confirmed in ARS's annual report, the present staff lacks the competence to carry out a program of improved agricultural techniques. Especially weak are the critical sections of rural works (construction and maintenance), supply (motor pool and pumps among other responsibilities) and training (animal traction, etc.). During a recent visit this was evidenced by:

- The inability to install or to conduct a test program on an animal-powered flow pump;
- Over half of their motor pumps lying idle and non-operational;
- Failure to respond to farmer's requests for small dike construction and pumping services;
- Infrequent and inept animal traction demonstrations;
- Supply rooms in disarray;
- Many project vehicles either disabled or in poor repair; and
- Absence of records on construction costs.

This lack of technical ability is exacerbated by the failure of the project's direction to give priority to technical needs. Within the project's managerial framework, engineering and logistics are generally downgraded.

Furthermore, ARS-farmer relations appear strained. The attitude of ARS Staff towards the farmers borders often on contempt. Both central and field staff on several occasions stated the need to oblige or even force farmers to follow ARS instruction. Yet, the staff did not know specifically what agro-technical package to introduce nor how best to introduce it in consonance with farmers' interests. Illustrative of this extension service-farmer relationship was ARS's reluctance to change the dike alignment to better suit village needs before actual construction and the difficulty experienced with farmers over operation and maintenance

of the system.

And yet, when asked about the most pressing project needs, the new Director replied with construction of extension agent housing, a more independent (from AID) accounting procedure and greater choice of commodity purchase.

Facilities: With its limited engineering resources, ARS has been able to build several small field offices as well as a main office. The field offices and storerooms are adequate, but suffer from poor design (poor use of space, ventilation, and lighting).

The successful, if delayed, completion of a new office building should ameliorate working conditions for the central ARS Staff. However, no improved facilities or renovations are underway for either the engineering or supply sections, another indication of the low priority accorded to technical and logistical operations by ARS management. Future plans include the reconstruction of an abandoned, dilapidated structure as a Director's house and an office for the engineering section. No cost figures were available for any past or present construction.

An adequate facility for a strengthened works sections would include offices for the engineer, the surveyor and their secretary, a drafting/design room, stockrooms, a supply warehouse and a garage with parts and tool storage. A strong operational section is a priority for a functional project.

Works: A detailed technical evaluation of the flood control works financed by this project is found in an earlier report, relevant portions of which are annexed. The significant points are as follows:

1. The scale of the major works was too large and ambitious; the works strained both USAID and the ~~contruction contractor~~'s (OTER's) capabilities, are beyond ARS ability to operate, and are not immediately relevant to farmers' needs.

~~2. The affected farmers had little (and then, only after vocal objection) involvement in the design and construction of the large works, due in part, to the previously mentioned scale of the operation.~~

3. Both the engineer (Genie Rural) and contractor (OTER) proved themselves competent to deisgn and construct such works. Again, mistakes were for the most part due to overambitious scale of the undertaking. OTER was invaluably assisted by $600,000 of AID-purchased earth-moving equipment. The development of the capability of this construction organization, is a most cost-effective investment in Mali's agricultural sector.

4. ARS does not have either the operational or technical ability to follow the construction of such works, to maintain them, or to design and help construct smaller flood control works.

OTER's current construction of the research station at Bagoundie is disimular from last year's in that both more time is allowed and more precision demanded. The latter is causing some difficulties since OTER has less experience with intensive, controlled irrigation systems. More-

over, the ARS Staff did not appear to understand the system, nor have the ability to operate it. No ARS Staff member has been following the design and construction. And, initial tests in the submersion perimeter were a total failure for lack of ARS follow-through and interest. Several years of technical assistance and training will be necessary to assure operation.

Equipment: A tour of the ARS garage, warehouse and storage rooms clearly shows this organization's lack of technical management and competence. ~~There is simply no demonstrated priority interest in operations or maintenance, which has resulted in idle vehicles, pumps and agricultural equipment.~~ Motor pumps are particularly critical due to heavy farmer demand for rentals during early rice growth. However, the ARS office at Tacherane which in principle serves approximately 500 farmers(?) (check ARS statistics), had only two 6HP pumps of which only one was operational during the planting season. Gargouna's office had three 4-5HP pumps, but only one was rented out (one broken and one "too heavy" to move).

ANNEX C

March 27, 1981

Consulting Agronomist, ARS-Gao, Dat Van Tran

Primary report on the activities of
Action Riz-Sorgho, Gao

ADO, Mr. Myron G. Smith
CROPS, Mr. Kurt Fuller
CROPS, Mr. Maurice Fleming

The primary report on Action Riz-Sorgho (ARS) is prepared for a period from 2/12/1981 to 3/20/1981 based on field trips, discussions with persons, and ARS reports.

Following are the observations and suggestions on:

1. Achievement of the Project
2. Tacharane and Gargouna cases
3. Crop situation
4. Extension works
5. Agricultural research station

I. ACHIEVEMENT OF THE PROJECT

According to the original project paper, by 1979 total annual cereal production in Gao area would increase to about 3,750 MT/yr and new varieties improved practices would be introduced to 10,000 farmers by (1) completely protecting from flood 5,000 ha. of rice by insubmersible dikes and using improved seeds, cultural practices with a yield of 1,300 kg/ha. (2) partially protecting from flood 5,000 ha. of rice and increasing yield by 900 kg/ha., and (3) increasing to 3,300 ha. of sorghum and using treated seeds with yield of 600 kg/ha.

Although the construction works were delayed more than 2 years, about 2,600 ha. of land at Tacharane and Gargouna (52% area target) are protected by 17km insubmersible dikes. The cleaning work for canals has not been completed until July 1981. Agricultural Research station has been built (dikes and canal systems only).

The goals of the Project were partly attained. According to the reports of ARS, grain yields of rice reached 1,338 kg/ha. in 1979-1980 crop and 1,865 kg/ha. in 1980-1981 crop (due to good rainfall). For sorghum, the

planted hectarage occupied 3,676 ha. in 1980-1981. However, the objective verifiable indicators did not go along very well: (a) the amount of annual cereal production did not increase as much as 3,750 MT/yr (except for the last year crop), (b) 18% rice land was planted with improved varieties in 1980-1981, (c) average grain yield of sorghum did not change at all (428 kg/ha in 1980-1981 crop), and (d) rice production was greatly fluctuated from 6,173 MT of rice (1978-1979), 2,828 MT (1979-1980) to 10,596 MT (1980-1981). Even at Tacharane and Gargouna where dikes and canal systems were installed, the crop successfulness still relies on rainfall and flood conditions.

In general, the project has not achieved completely its planned purposes, it has made some contribution to the regional development yet; but the efficiency of the Project is not greatly satisfactory. The main reason for that is the works required to meet the goals have not been completed yet.

It is possible to satisfy the entire project goal and improve project afficiency for flooded area by completing the following 2 steps:

(2) control flood and supply water efficiently (constructing dikes is mainly for flood control).

(2) change crop system.

The project is now being in the first step.

Suggestions: The project would be continued with new directions:

(A) concentrate works on the pilot project (a part of Tacharane proposed) in which the above steps have to be completed (see below - Tacharane and Gargouna cases). Then the project will expand to another area, step by step with experiences gained from the previous work.

(B) Strengthen the extension system of ARS, expand their works to more farming, and choose priority related to the important local constraints which are faced by the more average small farmers in the intervention area.

II. TACHARANE AND GARGOUNA CASES

Dike construction was started at Tacharane in March 1979, at Gargouna 3 months later and was terminated in August 1979. The system of canals has not been finished until July 1981. The total cultivated area protected by these dikes is about 2,600ha., with 1,285 ha. of rice and 850 ha. of sorghum cultivated in 1980-1981. Although rice production was not stable due to unusual climate, local farmers received some benefits from the construction works in the last two years:

1. The cultivated area of sorghum increased from 411 to 902 ha.
2. The flood spead and rizophage fish species were mostly controlled.

These two factors only could not contribute to the significant increase in the cereal production, since (1) farmers still practice the same cropping pattern, i.e. floating rice at the low land and sorghum at higher land; therefore (2) they grow one crop a year, (3) crop success is still determined mainly by the unpredictable factors—rainfall, flood— and (4) cultural methods are not changed much, except for selected varieties and treated seeds.

If the objectives of dike construction were to regulate the flood speed and control rice eating fish, the project were achieved. Many people have such thought. Local farmers at Tacharane and Gargouna are really happy with new dikes that are bigger than the old ones. Consequently, it is not surprising that all canals in the project go from highest land to the lowest land (or basin) aiming at the conduction of water from the Niger river to the field and/or from the basin to other parts of the field under flooded condition (not for irrigated crops). Under such a situation the exploitation in dikes and canal systems for increased production of floating rice crop could not obtain great efficiency.

SUGGESTIONS:

- Method 1: Pilot Project

It is necessary to have a small pilot project to prove the maximum benefit that could be gained from investment in dikes and canals.

Actually, with the existence of dikes, canals and inexhaustible source of water, farmers still grow floating rice. Why? The only answer from everyone is because of the unfavorable topography of plains or uneven soil surface which is a common characteristic of annually flooded area at anywhere in the world. In South-east Asia, farmers have strived to level their land individually along both sides of Mekong river by using draft animals however, land is not truly even.

An ambitious exploitation on flooded area in Niger costs its country 6,000,000 MF/ha. for the whole operation including levelling work according to the report of Mr. Houseeyni Konaré dated January 28, 1981 (Mr. Konaré is a staff member of Action Riz-Sorgho). At this moment, such an investment would not be practical for the region such as Gao.

After a series of discussions with the ARS STAff members and a few local people, solution may practically be found for the problem of levelling of flooded area. The idea of the solution is based on (1) using system of gravity irrigation and (2) mobilizing the participation of individual farmers.

Therefore, a small pilot project is proposed at the plain of Tacharane where 376 farmers exploit on 892 ha. with rice and sorghum crop in 1980-81.

Objectives: The pilot project consists of 3 interventions:

1. Increasing cereal production at the intervention area by eliminating floating rice crop and introducing double irrigated rice crop or rice-other crops.

2. Increasing crop production by increasing area cultivated by supplying water in dry season.

3. Introducing new crops and modern techniques to the farmers.

Proposed solution: The pilot project has to pass through the following steps:

1. Control flood and supply water efficiently: Controlling flood was already done by dike construction. Now the system of water supply from the river to field has to be appropriate to the topography of field. Two kinds of work may be executed:

   a) Constructing of a "floating canal": a proper floating canal could be installed on land along the existing dikes where the highest soil level is found. This type of canal has two advantages: (i) no water pump is required to bring water from main or secondary canals to the field, (ii) an amount of water needed can go into indifidual fields even when soil surface is not levelled. Concurrently, farmers are obligated to build or repair their own small dikes which can hold just enough water in the field for rice planting (i.e. water is not allowed to overflow into surrounding fields). As a result, farmers would gradually level their land by themselves in order to have water evenly cover the whole field and obtain a good crop. The existing canals and basins can be used or modified for the drainage system.

   b) Pump station: To assure the first crop during early flood season and to help farmers to grow two or more crops on the same land, after flood season a water pump station may be set up. A good site of river with water available all year round and close to the dike was found in the plain of Tacharane.

The pump station would function only for 3-4 months a year, thereby gasoline (or diesel) consumption and pump maintenance would not be a big problem for farmers.

In the first step, a major work (dikes and canals) has been done and additional construction (floatant canal and pump station) if any, would increase significantly the success possibility of the original project.

2. Change Crop System:

After completing the first step, the present cropping pattern -floating rice crop- has no reason to be existant. Two irrigated rice crops or rice followed by other crops, combined with modern techniques will be introduced to farmers to maximize crop production in the pilot project.

In the second step, ARS would concentrate its work for the pilot project, as follows:

a) Explain the idea and concept of pilot project to exploitants. Mobilize the participation and consultation of farmers from beginning to the end of the project.

b) Concurrent to construction work, ARS would carry out the training sessions for cadres, farmers: (i) how level land (thank to soil properties at Cao characterized by sandy loam or/and sandy clay, dry land preparation as well as levelling could be done by anim such as oxen, donkeys), (ii) how to grow high yielding varieties of rice and other crops.

c) Test locally new varieties, new crops and prepare seed source available for farmers right after construction work is done.

d) Organize farmers to manage water use in the project

e) ARS may cooperate with local cooperatives in the suppl of inputs for crops because of great needs from farmer predicted.

Implementation Plan: The pilot project may be executed for 5 years.

Step 1: control flood and supply water efficiently: It would be completed with system of floating canal and pump station in the first year or a part of canal each year

Step 2: Change Crop System: The effort of ARS may concentrate on a limited area of intervention or about 50 ha. during the first year. The work will then be expanded to a larger area during the second year and completed during the 5th year.

- Method 2: Using improved varieties and proper cultural practices for the present conditions.

This method would moderately increase crop production at Tacharane and Gargouna while looking for a good solution. With the existing dikes, canals, and uneven land the production is still limited by rainfall and flood. The lack of rainfall and late flood arrival may cause the loss of seeds and seedlings. Transplanting method and late opening of water gates may avoid the above problems.

Due to topography, field may be classified in 3 categories: lowland middle land and high land by water levels.

a) Lowland and middle land: (water level above 1m and 0.50 to 1m respectively): This zone may be used for floating rice crop while improved varieties combined with 2 obligatory measures:

(i) Late opening of the water gates: Based on the flood history of intervention area, the latest arrival of flood may be used for the date of gate opening every year to assure farmers in preparing nursery ahead in time.

(ii) Transplanting: Method 2 can be applied when most farmers in the zone agree to accept transplanting method for growing floating rice. With the fixed date of gate opening, farmers would be aware of when water comes to their terrace, and thereby when the nursery must be started. Different terraces have to be transplanted with young rice plants at 7 to 15 days intervals which give plants enough time to restore the growth and survive after transplanting. ARS may help farmers to classify terraces and give them recommendations on dates of nursery preparation and transplanting. This year, therefore, ARS would notice the calendar of water arrival and identify different terraces in the plain of Tacharane and Gargouna in order to be ready for next year campaign.

b) High land (water level below 0.5m): At this terrace, (about 20-30% of total area) high yielding varieties of rice or new crops may be introduced to farmers with 3 conditions: (1) farmers have to make small dikes around their field, (2) level field by themselves with labor or animal, and (3) use early maturing varieties.

It is hopeful that ARS may set up a demonstration plot of 1/4 to 1/2 ha. with high yielding varieties of rice for this type of terrace at Tacharane and Cargouns this year.

The method 2 would be a good preparation for the implementation of method 1 if the latter is carried out.

III. THE CROP SITUATION

At present, sorghum crop was completely transplanted and directly seeded while rice crop does not start yet. In general, some progresses were made in seed treatment and improved varieties of rice in the intervention areas.

Sorgho: In 1980-1981, sorghum was planted on 3,676 ha. with grain yield of 428 kg/ha. Some characteristics of sorghum crop are noticed:

- No improved varieties introduced
- Local varieties have long growth duration (8-10 months)
- No use of fertilizers and pesticides.
- Lack of land preparation (92% of cultivated area)
- 98% transplanted and 2% seeded.
- Very large spacing (more or less 4m). No row planting
- Amount and distribution of rainfall and flood determine crop success.

Rice: In 1980-1981, rice was grown on 7,523 ha. with average grain yield of 1,856 t/ha. Some characteristics of rice crop are known as follows:

- Improved varieties (O. Sativa) occupy 18%; some of them have long growth duration that farmers do not like.
- Improved seeds are permanently insufficient.
- Land preparation by labor or none.
- Little use of inputs (fertilizers, pesticides).
- Transplanting 18% and direct seeding 82%.
- Problem of birds, rice-eating fish.
- Crop success is completely controlled by pluviometry and flood.

For cropping pattern, as mentioned earlier, rice crop is always planted on low land while sorghum crop is reserved for high-lying area. In the other countries, farmers can grow two crops on the flooded area without dikes by using water pumps. So, the precondition to change cropping system in the region, such as Gao for increased production is how to bring water efficiently to fields when needed. Some attempts to use the Pakistan type of pumps was not successful. The Egyptian type-or-drawn water-lifting wheel (noria) has not been conclusively tested. It seems that while looking for the cheap and reasonable way to supply water to crops, motor pumps are still a possible solution for increasing production in the region although some effects may be encountered.

Suggestions: With many unfavorable aspects of crop cultivation to be improved and with the actual capacity of ARS, it is recommended to give priority to the plan of implementation. The following works are suggested:

1) Testing noria pump: It is necessary to assign a person from ARS to take care of noria test and evaluation (choosing location, schedule, installation, testing, evaluation and report). The work would be carried out as soon as possible.

2) Supplying rice seeds sufficiently and in time: Seed supply becomes a permanent concern to ARS. Seed source never meets the requirements of farmers and its distribution is usually late for planting. This problem can be found in any annual report of ARS. Therefore, a program of seed multiplication for Gao is proposed (see Appendix I). However, the proposal may have an institutional problem with O.P.S. (Operation Production Semences). An agreement between ARS and OPS is required before executing the program.

3) Adaptive research: The program of adaptive research would be carried out at two levels: Agricultural research station and farmer fields. The research undertaken would be of an immediately applicable nature and concentrate on the following aspects:

a) Varietal test: to test and identify suitable floatin and low-land rice varieties and sorghum varieties. This year, a program of varietal test for rice is proposed to carry out at 4 locations of Gao: Magnadou Gargouna, Bara, and research station (see Appendix II) Sorghum crop was already planted in February.

b) Cultural practices: seedling ages, plant density, fertilizer rates (chemical, organic manure, compost), pesticides, water management would be considered.

c) Cropping patterns: Crop rotation among rice, sorghum legumes, and other crops could be tested whenever wat supply for crop is available.

IV. EXTENSION WORK

The cultural method in this region is relatively primitive, i.e. less labor, less inputs and thereby less production. Normally, the effects of extension work are slowly accepted by farmers, except for some interesting motives, such as attractive profits from changes in cropping patterns. Therefore, the role of extension work becomes indispensable in the scheme of rural development. The hard and durable works are expected to get good outcomes. From this, the extension system is deserves to be consolidated and expanded to the whole intervention area.

Some characteristics of the current situation of extension system in ARS are noted:

(1) A limited number of technicians and "cadres" cover a large number of farmers ("cadres" to farmers ratio: 1:4).

(2) "Cadres" who work directly with farmers receive a short training and they lack experiences acquired by practice in the intensive production methods.

(3) Shortage of place, teaching aids, and documents for training and materials required for demonstration.

Suggestions: To from the technological basis at rural area the following works are suggested:

1. Increase the number of qualified technicians and "cadres" to meet the requirement.

2. Establish a training and demonstration center which may be located in the agricultural research station. The center will provide a basic training for all levels of local personnels learning by practices. The "Cadres" have to be self-confident in their knowledges before convincing farmers.

3. Supply sufficient materials, equipments, documents required for training and demonstration.

4. ARS may concentrate much more work on special problems such as: animal traction, noria pump, improved varieties, fertilizer use, thresher.

V. AGRICULTURAL RESEARCH STATION

It may be necessary to establish an agricultural research station at Gao because:

1. Gao is an isolated and remote area which has extremely local conditions distinct from other regions.

2. The improved varieties of rice imported from WARDA are not widely accepted by farmers because of their inadaptability and long growth cycle.

3. The agricultural research station will be a good start of the program of seed multiplication, if any, and may become a center of training and demonstration.

4. Seed supply is permanently insufficient.

5. No agricultural research station exists in Gao.

Current situation:

The agricultural research station has been carried out on 20 ha. of the plain of Tacharane since May 1980, with 4 major works planned:

(a) A surrounding insubmersible dike and a longitudinal dike dividing the station into 2 sections (6 has used for floating rice tests and 14 ha. reserved for irrigated crop test) was finished.

(b) A system of floating canal with main, secondary and tertiary has been built.

(c) It is expected to receive motor-pumps from USAID

(d) Office, storage and others (equipments, material) are not started yet.

Because of the lack in technical assistance, the works done at the research station (a, b) were found with 2 defects: (i) land was not levelled before installing canal system even when the area is small, resulting in sinuous shapes of canals, and some difficulties for future experiments, (ii) the existing canals (except for the main canal) are planned for overflow irrigation which narrows opened canals made by ciment, instead of a series of valve-controlled pipes. Consequently, water cannot be controlled for each field as desired; hot weather may cause great water loss, and over-flowing water may erode the base of canals.

Suggestion: The agricultural research station deserves to be supported because of its multi-purposes: adaptive research, seed production, and training and demonstration.

SUMMARY

1) Although the construction works began late, the area target of PP was reached about 51%. Some progress were made in seed treatment, improved varieties, increased hectarage of sorghum and cereal production. So, the overall goals were partly achieved. However, the efficiency of project seems relatively low regarding investment in the construction.

2) A small pilot project is proposed to show the improved efficiency of project. With reasonably additional works in plain of Tacharane, crop production may increase greatly as compared to actual situation by changes in cropping pattern, improved crop yields, and increased area cultivated.

Alternatively, to improve the present production at Tacharane and Gargouna an improvement of cultural methods and introducing of high yielding varieties of rice to a part of the plain have to be done.

3) The program of seed multiplication is proposed to solve permanent problems of seed supply for ARS.

4) A program of adaptive research is suggested to identify suitable improved varieties for farmers.

5) To establish the technological bases for future rural development, extension systemshas to be intensified with enough staff members, sufficient equipments, materials, documents, and a suitable place for training and demonstration works.

6) An agricultural research station in Gao is needed for adaptive research, seed multiplication and perhaps training and demonstration.

With many separate plains along both sides of Niger river, Gao really has a potential to be self-supporting in their staple foods. Some modifications and redesign of the original project will promote substantially increased production of crop in the intervention area.

APPENDIX I : Program of Seed Multiplication at the 7th Region.

I - Reasons for seed multiplication program at the 7th Region

The situation of seed supply at the Region has become a permanent concern to the Action Riz-Sorgho because of the following reasons:

1) the sources of supply (Mopti and Ségou) are remote from area cultivated (500 km or more) and costly due to transportation;

2) seeds are always insufficient and the supply is too late every year;

3) improved varieties imported are not adapted to local conditions;

4) farmers usually lose their seeds due to the irregular pluviometry.

II - Objective

The program of seed multiplication will provide 220 tons of selected seeds to farmers each year. This amount of seeds will satisfy only one fourth of the area cultivated a year, i.e. 2,500 ha. After 4 years the improved seeds would cover major area cultivated; then the new source of selected seeds will be introduced to farmers.

III - Implementation of the seed multiplication program

In general, seed multiplication consists of four phases:

1) Breeder seeds are produced at Central Research Station such as Mopti or others;

2) Foundation seeds are produced at Regional Agricultural Research Station of the 7th Region (RARS) with 1,6 ton at 2,7 ha;

3) Registered seeds are produced at RARS and contract farmer fields with 16 tons at 20 hac

4) Certified seeds are produced at contract farmers' fields with 200 tons of seeds on 200 ha.

Summary of seed multiplication program for floating rice at the 7th Region

Years	Phase	Yield Tons/ha Tons/ha	Area Ha.	production Tons	Locations
	Breeder seeds	-	-	0,216	Warda or others
1981-82	Foundation seeds	0.6	2.7	1.6	RARS
1982-83	Registered seeds	0.8	20.0	16.0	RARS - Farmer fields
1983-84	Certified seeds	1.0	200.0	200.0	Farmer fields

Phase III or Certified seeds becomes the most crutial among the phases since it will increase a tremendous amount of seeds available for the farmers' needs. In order to achieve the above goal two important aspects must be considered:

a) Technical aspect

The program requires at least one seed specialist at each section to follow-up the conditions of seed fields and advise the growers to maintain the quality of seeds. A short term training on seed production would be provided for the section chiefs who will become field controllers.

A small size of seed laboratory with a minimum equipments such as, seed germinator, moisture tester, purity determining instrument, seed separator, plastic trays, paper towels, cotton... should be set up at the RARS to test the quality of seeds. And the criteria for seedquality would be established by the local government.

b) Financial aspect

A revolving fund would be available to buy 200 tons of registered and certified seeds from contract farmers. Then seeds will be loaned to other farmers for planting next year. This procedure will save a lot of expenses from transportation and avoid the lateness of seed supply happening every year.

The revolving fund would be MF 36,000,000 to collect 200 tons of registered and certified seeds at the price of MF 180/kg. A part of the fund will come from seeds collected from previous years.

APPENDIX II : Program of adaptive research at the 7th Region. 1981-82.

VARIETAL TEST

I - Objectives

There are some different comments on the performance of selected cultivars imported from WARDA, Mopti. Also, annual reports of Action Riz-Sorgho (ARS) did not show the superiority in grain yield of selected cultivars over the local ones. Therefore, the objective of this experiment is to test the adaptability of selected cultivars as compared with local cultivars at the 7th Region.

II - Locations

The experiment will be carried out at Agricultural research station and farmer fields at Magnadoua, Gargouna, and Bara.

III - Cultivars

The ten cultivars will be used at seeding rate of 80kg/ha:

Local:	Moberi	Selected:	Mali Sawn
	Kossa		DS 52 - 37
	Loubi		Nang Kieu
	Sabaria		BH_2
	Tétéra (chun)		Khao Grawn (chuk)

IV - Experimental design

The design of completely randonized block will be supplied with four replications and ten cultivars. Plot dimension will be of 3 x 5m (Table 1).

V - Cultural practices (Table 2)

Land preparation: soil will be plowed once after water recession and harrowed twice before sowing.

Fertilization : the formula 64 - 45 - 0 Will be applied under the form of ammonium phosphate (35%) and urea (46%). All ammonium phosphate will be incorporated into soil during land preparation. Urea will be applied a week before flood arrival.

Weeding: Hand weeding will be done at the seedling stage and flodd arrival, if necessary.

Insecticide: HCH (25%) will be applied at 2.5 kg a.i/ha at 4-week intervals starting one month after flooding.

VI - Data collection

- date of land preparation
- date of fertilizer application
- date of sowing and germination
- date of first flood arrival
- elongation and water level at 3-day intervals (Research Station only)
- date of 50% heading
- date of harvest
- grain yield (cut 9 rows of 13 rows at the center of the plot and discard two border rows at each side; thresh them and take the weight 3 days after drying in the field)
- record all incidences and estimate damages during growing season
- grain yield components (research station only) taken by using iron frame of 30 x 66 cm
- grain - straw ratio (research station only).

VII - Materials (4 locations)

- 10 cultivars	: 4kg/variety	
- fertilizer	: urea (46%)	: 39 kg
	ammonium (35%)	: 37 kg
- thiocal	: 3 sacks	
- HCH (25%)	: 2.4 kg	
- stakes	: 22	
- strings	: 506 m/experiment	
- row maker	: 2	
- measurement stakes	: 4	
- land	: 23 x 34 m/experiment	
- labor	: cadres and farmers.	

VARIETAL COLLECTION

I - Objectives

Local varieties and promissing varieties (or lines) will be collected from different sources and evaluated for their performance under local conditions. Hopefully, some of them may be suitable to the environment of the 7th Region.

The varieties collected will include both floating rice and irrigated rice.

II - Experimental methods

1. Seeds of each variety are sown on the three 3-m rows with 25 cm between rows;
2. land preparation is done by plowing once and harrowing twice:
3. fertilizer formula used is 64 -45 - 0;
4. hand weeding twice: one and two months after sowing;
5. no insecticide and fungicide treatment is required.

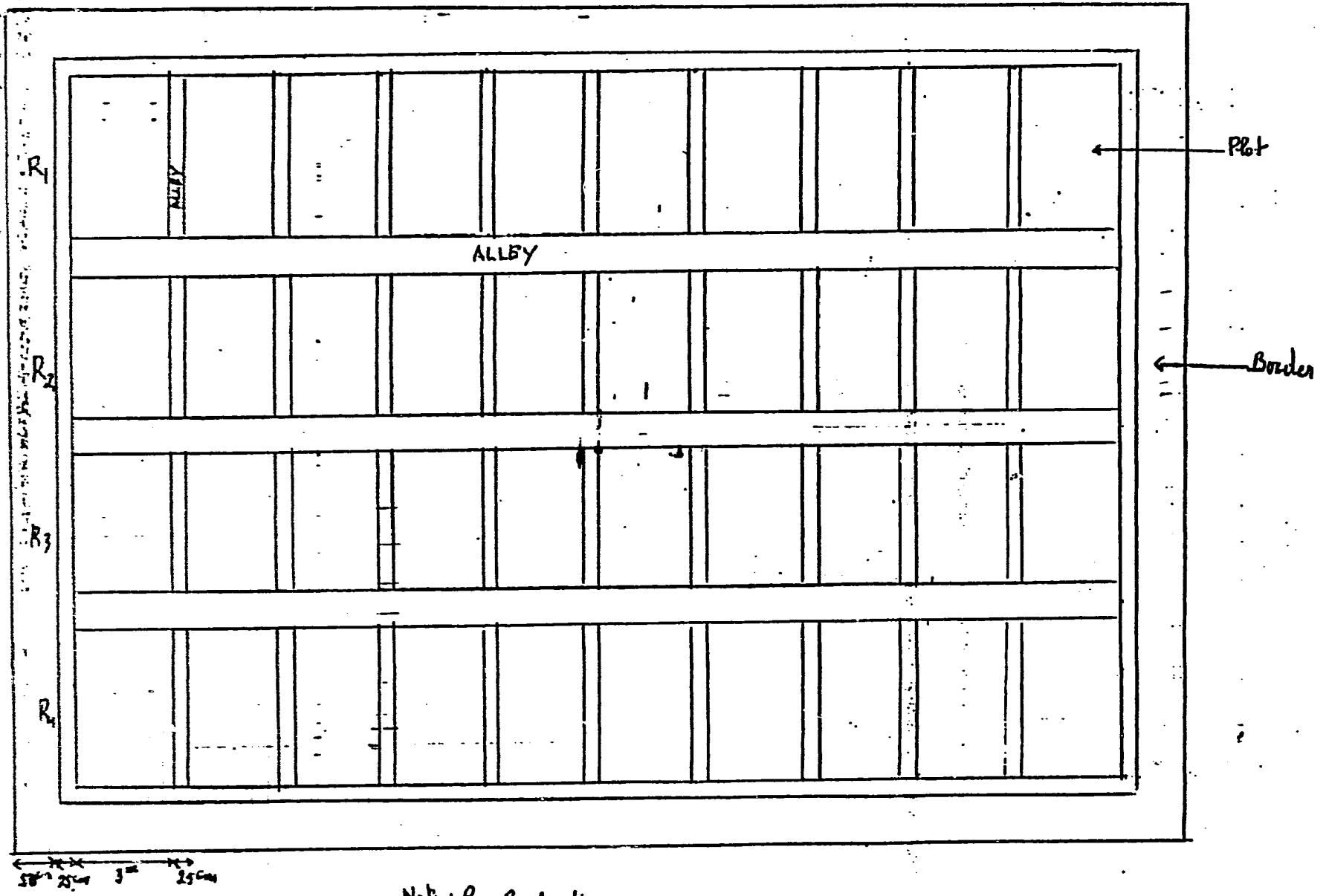
III - Data collection

1. Date of sowing
2. Date of 50% flowering
3. Date of first and last flowering
4. Plant height
5. Date of harvest
6. Degree of resistance to pests
7. Panicle weight (10 panicles taken at random for each variety)
8. Grain number/panicle
9. Sterility percentage.

IV - Material preparation

1. Varieties (or lines): collect from different sources
2. Fertilizer: 64-45-0
3. Stakes, tags, sacks, envelop',...

Table 1 = EXPERIMENTAL DESIGN OF VARIETAL TEST (1981-82)



Note : R = Replication

Table 2: Tentative work schedule (Varietal test (1981-1982