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FARM BUDGET STUDY  
FOR BAKEL IRRIGATED PERIMETERS

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I. BASE DATA

Year : 1977-78, i.e. rainy season of 1977

Locale : Ballou

Crops : Hivernage (rainy season) : 30 ha. rice  
Contresaison (pcst-rainy season): 9 ha. maize

Average Hivernage : .20 ha.  
Farm Size

Ballou the perimeter on which this study is based is the largest perimeter in the Bakel Project area, accounting for over one-third of total hivernage area cultivated in 1977. According to SAED's yield study (1), Ballou's yields were close to project-wide yields per hectare. 1977 is Ballou's third year of production and its first year under USAID financing.

In 1977, 18 hectares were farmed individually by 88 families (.20 ha./family) while the remaining 12 hectares was farmed collectively by the village as a whole. SAED officials project that collective farms will decrease in importance in future years and that individual family farms will increase in size. This study is based on costs and returns analysis for an individual family farm.

Farm budgets are presented on the following pages using both financial and economic analysis,<sup>1/</sup> employing varying estimates of product prices and yields/ha. The data are based on interviews with SAED personnel in Bakel and their records and reports.

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<sup>1/</sup> Financial analysis presents the costs and benefits to the participants in the project as opposed to economic analysis which measures costs and benefits to society as a whole. For example, Urea fertilizer in financial analysis is costed at the price farmers pay - 35 FCFA. In economic analysis it is costed at the price the Government pays to import Urea fertilizer: 54 FCFA/kg.

II. ENTERPRISE BUDGETS

TABLE 1

RICE ENTERPRISE BUDGET USING FINANCIAL ANALYSIS  
(all data on a per hectare basis except where otherwise stated)

		<u>FCFA</u>
1. Value of output		<u>195,000</u>
2. Variable costs		
a) Fertilizer		
1) 150 kg 16-48-0	3,750	
2) 100 kg Potassium chloride	2,500	
3) 150 kg Urea	5,250	
Total		<u>11,500</u>
b) Seed (80 kg)		<u>4,000</u>
c) Pumping costs		
1) Fuel (350 litres)	26,250	
2) Oil (15 litres)	5,250	
3) Maintenance	0	
Total		<u>31,500</u>
3. Gross margin/ha.		<u>148,000</u>
4. Tools, equipment, depreciation		
a. Tools		
1) 0.2 seeders	516	
2) wheelbarrows	0	
3) 0.3 picks	88	
4) 0.3 shovels	88	
5) 10 hoes	500	
6) 10 sickles	750	
7) 40 bags	1,333	
Total		<u>3,275</u>
b. Payments to farmer group for hired workers		<u>2,667</u>
c. Payments to farmer group for pump replacement		<u>3,600</u>
5. Net margin/ha.		<u>138,458</u>
6. Net margin/farm (0.2 ha.)		<u>27,691</u>
7. Person-days of work (5 hours/day)		<u>106</u>
8. Net margin/person-day		<u>261</u>

NOTES - RICE

Value of Output

Yields/hectare in Ballou for 1977/78 were 3.9 tons/ha. based on a thorough yield survey conducted by SAED (1). The random yield-plot method was used and at Ballou, 24 plots on 12 farms were examined. For the Bakel area as a whole 56 plots on 28 farms were examined. The project-wide yield per hectare was 3.8 tons.

The price of rice used in this study is the average annual market price for paddy at Bakel - 50 CFA/kg, as observed by local encadreurs. The official price of rice is 41.5 FCFA/kg but SAED is not yet buying rice in the area.

Fertilizer

Farm level prices:

16-48-0	25 FCFA/kg
Potassium chlorate	25 FCFA/kg
Urea	35 FCFA/kg

Farmers receive fertilizer on credit before the crop year begins and pay SAED after harvest. No interest is charged. Almost all farmers use recommended quantities of fertilizer.

Seed

Almost all seed is obtained from previous year stock. Price is average market price.

Pumping Costs

In 1977-78, an Italian pump was used to supply water at Ballou. Since the majority of pumps in use and to be installed in the project are Gorman HR2's, data for this pump are more appropriate for this study. Thus pumping costs/ha for 1977/78 in this analysis were taken from Arroundou which is close to Ballou. Project staff claim that quantities of water used in the two perimeters were about the same.

### Fuel and Oil Costs

Fuel and oil costs were taken from records of actual quantities used. 1,400 liters of gas-oil (fuel) and 60 liters of oil were used for 2 ha. of rice (hivernage) and 3 ha. of maize (contre-saison).

Figures are higher than what could be considered normal (see 2, P.7-10) because of the low rainfall in the 1977 hivernage (392 mm vs. an annual average of 712 mm) and operational problems. Cost of fuel and oil are 75 FCFA and 350 FCFA/litre respectively.

Sixty percent of the total annual costs are charged to rice which the remaining 40% are charged to maize, in accordance with their estimated relative water consumption.

Maintenance is not costed because it is carried out free of charge by SAED.

### Tools and Equipment

<u>Tools</u>	<u>no./ha</u>	<u>Price/Tool</u>	<u>Life(yrs)</u>
Seeders	0.2	12,890	5
Wheelbarrows		(supplied by SAED at no charge)	
Picks	0.3	1,991	5
Shovels	0.3	1,991	5
Hoes	10	500	5
Sickles	10	750	5
Bags	40	100	3

The farmer group owns 6 seeders, 10 picks and 10 shovels. 2/3 of their costs are charged to rice production in this analysis. Half of the cost of hoes and sickles is charged to rice production.

### Contracted Workers

The farmer group hires a pump operator and a watchman for 10,000 FCFA/month for 4 months.

### Pump Replacement Fund

Although no payment to this fund was made in 1977/78, SAED personnel plan to collect 300,000 FCFA/yr at Ballou starting 1978/79 (during which 50 ha. were cultivated) as the farmers annual contribution to pump replacement. In this study 60% of the contributions to this fund are charged to rice production (hivernage) and 40% to maize production (contre-saison).

The life of the pump is estimated to be 7 years, and total cost, including accessories and installation is estimated to be 2.5 million FCFA.

### Land Costs

There is no charge for farming land in the project, nor is there any rental system. In the short run, at least, it is probable that supply of irrigated land will exceed the demand. Therefore land costs are assumed to be zero.

### Establishment Costs

Establishment of irrigation works is not costed in this analysis. All monetary costs (mechanical equipment, material, etc.) were paid for by SAED, while farmers contributed slack season labor.

TABLE 2

ANNUAL AVERAGE FARM LABOR PROFILE (0.2 HA.)

	<u>Hours</u>
Ditches and canal maintenance	140
Leveling	28
Land preparation	60
Fertilizing	4
Direct seeding	8
Irrigation	14
Weeding	108
Birdscaring	80
Harvesting	24
Threshing and Winnowing	12
Collective work	4
Miscellaneous (10%)	<u>48</u>
Total	530
	106

This table was constructed from an interview with a Bakel farmer and an encadreur. Since birdscaring is done by children the number of hours is divided by 2, i.e. once child day = .5 person-day. All other work is assumed to be carried out by adults.

The average farmer doesn't use hired labor. Some farmers with large farms and/or small families employ hired labor during the peak season weeding and harvesting - for 300 FCFA per 5 hour/day.

TABLE 3

MAIZE ENTERPRISE BUDGET USING FINANCIAL ANALYSIS  
(All data on a per hectare basis except where otherwise stated).

		<u>FCFA</u>
1. Value of output/ha.		<u>112,500</u>
2. Variable costs/ha.		
a. Fertilizer		
1) 150 kg mixed fertilizers	3,750	
2) 100 kg Potassium chloride	2,500	
3) 200 kg Urea	7,000	
Total		<u>13,250</u>
b. Seed (25 kg)		<u>1,125</u>
c. Pumping Costs		
1) Fuel (233 litres)	17,475	
2) Oil (10 litres)	3,500	
3) Maintenance	0	
Total		<u>20,975</u>
3. Gross margin/ha.		<u>77,150</u>
4. Tools, equipment, depreciation		
a. Tools		
1) 0.3 picks	45	
2) 0.3 shovels	45	
3) 10 hoes	250	
Total		<u>340</u>
b. Payments to farmer groups for hired workers		<u>2,000</u>
c. Payments to farmer group for pump replacement		<u>2,400</u>
5. Net margin/ha.		<u>72,410</u>
6. Net margin/farm (0.2 ha.)		<u>14,482</u>
7. Person-days of work		<u>53</u>
8. Net margin/man-day		<u>273</u>



NOTES - MAIZE

See also notes for Rice Budget.

Value of Output

Yield per hectare in the Bakel area is about 2.5 tons according to rough estimates made by SAED personnel in Bakel.

They also estimate that the average price of maize during 1977/78 was 45 FCFA as compared to the official price of 37 FCFA/kg.

Fertilizer

Farm level prices:

Phosphate	25 FCFA
Potassium chloride	25 FCFA
Urea	35 FCFA

Seed

Price is average market price as estimated by SAED personnel.

Pumping Costs

See "pumping costs" under rice notes.

Tools and Equipment

1/3 of shovel and pick costs under rice tool costs are charged to maize production. 1/4 of hoe costs are charged to maize production.

Contracted Workers

The farmer group hires a pump operator and a watchman for 10,000 FCFA/month for 3 months.

Pump Replacement

See Rice notes.

Person-Days of Work

It is estimated by SAED officials at Bakel that a maize crop requires about half the labor of a rice crop.

Farm Labor Profile

Not available. Maize crop is assumed to require half the labor of a rice crop.

III. FARM BUDGET ANALYSIS

TABLE 4

FARM BUDGET ANALYSIS USING VARYING ASSUMPTIONS

A. DOUBLE CROPPING

	Using Reported Yields <sup>1)</sup>			Using Revised Yield Estimates <sup>2)</sup>		
	Financial Analysis <sup>3)</sup>	Economic Analysis <sup>4)</sup>	Financial Analysis using off.grain prices <sup>5)</sup>	Financial Analysis <sup>3)</sup>	Economic Analysis <sup>4)</sup>	Financial Analysis using off.grain prices <sup>5)</sup>
<u>RICE</u>						
Value output	195,000	195,000	161,850	150,000	150,000	124,500
Gross margin/ha	148,000	136,115	114,850	103,000	91,115	77,500
Net margin/ha	138,458	119,488	105,308	93,458	74,488	67,958
Net margin/farm	27,691	23,897	21,061	18,691	14,897	13,591
Net margin/man-day	261	225	199	176	140	128
<u>MAIZE</u>						
Value output	112,500	112,500	92,500	90,000	90,000	74,000
Gross margin/ha	77,150	65,743	57,150	54,650	43,243	38,650
Net margin/ha	72,410	53,879	52,410	49,910	31,379	33,910
Net margin/farm	14,482	10,775	10,482	9,982	6,276	6,782
Net margin/man-day	273	203	198	188	118	128
<u>TOTAL</u>						
Value output	307,500	307,500	254,350	240,000	240,000	198,500
Gross margin/ha	225,150	201,858	172,000	157,650	134,358	116,150
Net margin/ha	210,868	173,367	157,718	143,368	105,867	101,868
Net margin/farm	42,093	36,672	31,543	28,673	21,173	20,373
Net margin/man-day	265	217	199	180	133	128

B. SINGLE CROPPING

<u>RICE</u>						
Value output	195,000	195,000	161,850	150,000	150,000	124,500
Gross margin/ha	148,000	136,115	114,850	103,000	91,115	77,500
Net margin/ha	136,058	109,966	102,908	91,058	64,966	65,558
Net margin/farm	27,212	21,993	20,581	18,212	12,993	13,111
Net margin/man-day	257	207	194	172	123	124

NOTES:

A. Double Cropping

Values are taken from Tables 1-3 according to the assumptions which follow:

Double cropping assumes a hivernage crop of rice followed by a contre-saison crop of maize.

- 1) Reported Yields - Rice: 3.8 T/ha. Maize: 2.5 T/ha.
- 2) Revised Yields - Rice: 3 T/ha. Maize: 2 T/ha.
- 3) Economic Analysis - Differs from above analysis in following ways:

a) Fertilizers costed at 1977 international prices:

Urea	54 FCFA/kg
Potassium chloride	38 FCFA/kg
Mixed fertilizer	48 FCFA/kg

b) Pump annual maintenance and repair costs at 30% of depreciation.

Total cost of Gorman HR2 pump including installation costs- 2,500,000 FCFA according to SERDA personnel at Bakel. Annual amortized payment (pump life of 7 years, pump serves 15 ha., assume zero salvage value) is 23,809 FCFA. Annual maintenance cost is thus 7,142. 60% of each of these costs is charged to rice and 40% to maize.

- 5) Financial Analysis Using Official Grain Prices - Same as number 1 above except official prices for rice and maize have been substituted for prevailing market prices.

B. Single Cropping

See notes to Part A.

Single cropping assumes a single hivernage crop of rice.

For financial analysis, payment to the farmer group for pump replacement is charged totally to rice production. For economic analysis, the annual amortized payment is charged totally to <sup>rice</sup> production.

#### IV. SUMMARY AND ANALYSIS

The preceding budgets demonstrate the profitability of the small irrigated perimeters at the farm level using both financial and economic analysis.

Using financial analysis, which shows the profitability of the project using costs facing the farmer, the net margin per hectare is 210,868 FCFA for a double-cropped hectare. This represents 42,093 FCFA for an average farm of 0.2. ha.

Using economic analysis in which farm subsidies on pump maintenance, fertilizer, and pump purchase are removed, net margins of 173,367 FCFA/ha and 34,672 FCFA/farm are still retained,

Although a farm budget of a pre-project Bakel Farm Family is not available, a budget drawn up in the Bakel Project Paper (3, Annex J, P.24) estimates average family farm income to be about 80,000 FCFA. For the average family involved in the project, then, farm income is increased by over 50%.

The budgets shown in this study compare quite favorably with those projected budgets for the project's 8th year of operation (3, Annex J. P.10). The projected budgets show yields per hectare of 4 tons and 3 tons per hectare for rice and maize respectively and a gross margin per hectare of 232,690 FCFA.<sup>1/</sup> Yields per hectare of 3.8 tons for rice and 2.5 tons for maize, with a financial net margin of 210,868 FCFA/ha. have already been realized. The economic net margin of 173,367 FCFA is only 25% lower than that projected for the 8th year.

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<sup>1/</sup> It is uncertain whether the budget in the Project Paper is economic or financial. Not enough detail about cost components are given to be able to compare projected costs with actual costs.

Table 4 present budget results under varying assumptions. Column 3 shows financial analysis using official grain prices, which presumably will come into play once the Bakel market has become saturated. Net margins decrease but still remain over 30,000 FCFA/ha. Columns 4-6 show financial, economic, and financial-official-price data using yield estimates 25% below reported yields.

This assumption reduces net margins by about 1/3, seriously threatening profitability of the project. Using financial analysis and official prices, net margins drop to just over 20,000 FCFA per 0.2 hectare farm.

The effects of only cultivating a single crop per year on the analysis is shown in Part B of Table 4. In these cases overhead costs associated with pump depreciation are charged totally against rice production. Using reported yields, net margins remain over 20,000 FCFA but in both economic and financial-official-price analysis they drop to about 13,000 FCFA. Although only 30% of Ballou's hivernage hectarage was cultivated in contresaison, this percentage is expected to increase as a water control problems are worked out

One factor not included in this study is the effect that rice cultivation has on production of dry-land crops. Although SAED officials at Bakel doubt that the dry-land area cultivated has been reduced, they do believe that yields per hectare have been lowered due to competition with rice cultivation. If yields dropped 10% on an average 2 ha. farm of hivernage millet-sorghum (3, Annex J. P.24) from 500 kg/ha, to 450 kg/ha. (see 4, P.VI.38) the loss would be 100 kg of cereal. Valued at the official millet price this grain would be worth 3,500 FCFA. This 3,500 FCFA could be entered as a cost against a 0.2 ha. rice farm.

In conclusion, irrigated cultivation is shown in this study to have gotten off to a very profitable start in the Bakel area. With double-cropping net margins/ha. remain over 100,000 FCFA/ha. even with the most pessimistic assumptions concerning yields and prices. <sup>And given that 1977 is the</sup> first year of the USAID project and third year of rice cultivation in the village studied, it is to be expected that results should improve ~~and~~ as infrastructure problems are worked out and farmers gain experience in irrigated agriculture.

Individual farm incomes should also increase as farm size increases. Although average farm size was only 0.2 ha. in Ballou in 1977, it was reported to have doubled in 1978 to 0.4 ha.

In conclusion, SAED officials point to two major problem areas which need to be addressed:

- a) Pumping inefficiencies - It is to be expected that in the first years of a project, this would be a problem. Included are inefficient use of fuel, wastage of water due to imperfections in the water-flow network, and maintenance problems.
- b) Reducing labor bottlenecks through the use of appropriate technology. The primary peak season is weeding in August-September. Harvesting is also a peak-labor activity, especially because it overlaps with the harvesting of dry-land millet, maize and peanuts.

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