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SOCIO-ECONOMIC MONITORING SYSTEM

Annual Report
for
Agricultural Year 1989-1990

Irrigation and Water Management Project

Harza Engineering Company
Technical Assistance Team

SAED - Bakel Delegation

USAID Contract No. 685-0280

SAED - Harza Contract No. 58/88.

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July, 1990

Executive Summary

1. This report summarizes findings for the agricultural year 1989-90 in the Bakel Delegation. Forty concessions or extended families were sampled in the project's three zones.

2. Two groups are included in the sample: Soninke farmers in riverain villages along the Senegal river, and Toucouleur farmers in villages along the Faleme river.

3. Soninke concessions average about 20 members with three married women; Toucouleur concessions average 11 members with 2 married women. The average age of Soninke chefs de concession is 54 years; Toucouler chefs de concession are 10 years younger.

4. An examination of dry season production shows 10 of the 40 sample concessions used irrigated perimeters. Some 19 of 40 concessions produced crops along the river after the water's recession. The average plot size for recession fields was 0.6 ha.; for irrigated plots it was just over .2 ha.

5. Labor requirements for irrigated rice are 343 person-days per hectare; for rain-fed cereals about 120 person-days per hectare; recession fields were found to be some 133 person-days per hectare; and for dry season irrigation, some 270 person-days per hectare.

6. Rainy season irrigated rice showed had an average yield of 2.7 tonnes/hectare. Rain-fed cereals (millet, sorghum, maize) had yields of less than 1 t./ha., mainly because of very poor rain fall. Dry season recession and rain-fed crops were assessed in terms of estimated total crop values. irrigation crop values were about 350,000 F.CFA. per ha. or about 8,600 F.CFA. per person-day of labor. Recession plots yielded about 127,000 F.CFA. per ha. or some 1,500 F.CFA. per person-day.

7. An number of analytical procedures (largely described in the Index of Tables) were employed to discern differences in the economic characteristics of irrigators and non-irrigators. There is good evidence to suggest that participation in irrigation is largely contingent on the availability of money remitted by family members living abroad. Given the current level of productivity and profitability, irrigated agriculture remains confined to a subsistence oriented-framework.

8. Analysis of income sources which make up the average concession's revenue portfolio show that remittances account for some 52 percent of total revenues, 39 percent is drawn from employment, and only 9 percent comes from the sale of agricultural and pastoral products. Pastoral product sales exceed sales of agricultural products. The average total annual revenue per concession was about 680,000 F.CFA. The highest

annual average per concession was the village of Diawara with 1,853,000 F.CFA.; the lowest was at Guita on the Faleme with only 211,000 F.CFA. in revenue reported during the monitoring period.

8. Livestock is an important "bank" for savings and investment. The average Soninke concession had livestock valued at just over 805,000 F.CFA.; the average Toucouleur concession's livestock assets were conservatively estimated at 1,520,000 F.CFA.

9. The principal conclusion of the report focuses on the relationship between remittance incomes and participation in irrigation. This relationship can be employed in the development of irrigation in the Bakel Delegation if SAED's efforts to raise productivity and improve perimeter profitability are to be successful.

10. The chief recommendation of the report is that work must be done to rehabilitate the producer organizations (groupements) especially as concerns the provision of credit, without which irrigated agriculture cannot move forward.

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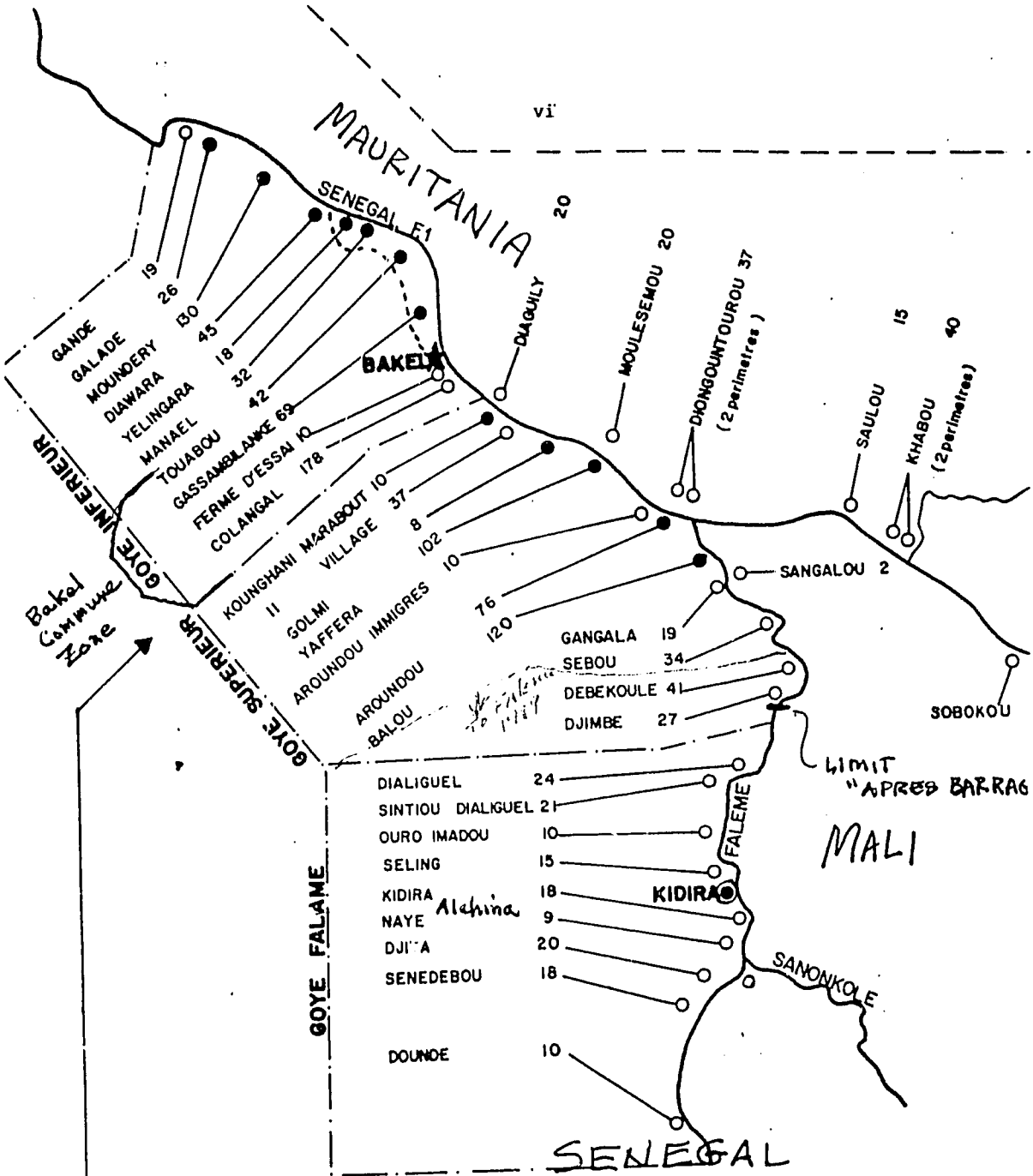

ZONE DE BAKEL

PERIMETRES	RIVES	SENEGAL	327 Ha
PERIMETRES	RIVES	FALEME	270 Ha
		TOTAL	597 Ha

• Federation Villages

I. Introduction

This report summarizes and analyzes data collected by the Harza Technical Assistance Team's Socio-Economic Monitoring System during the agricultural year July, 1989 to June 1990. The report begins with a review of findings from monitoring system data collected during the all-important "hivernage" or rainy season (normally June-July to September). Findings from this period are also analyzed in the Monitoring System Interim Report (April, 1990).

This section is followed by an examination of data collected during the later half of the agricultural year (January to June, 1990). This is a relatively slow period during which agricultural activities are somewhat diminished compared to the rainy season. This period is used for two types of agricultural production. The first is recession agriculture; that is, the use of wetted or humid land along the river banks and river bottom which are exposed by the annual recession of the Senegal and Faleme rivers. The second option during the dry seasons is irrigation in the Delegation's perimeters.

The annual cycle of agricultural production in the Bakel Delegation is shown below in Figure 1.

Figure 1
Agricultural Calendar
Bakel Delegation

```
A
c
t                 Early Rice
i
v                          Late Rice
i                                 Recession Crops
t                                 maize, sweet potatoes,
y     Rain-fed crops                     small hand irrigation
       sorghum, maize, millet                 veg. gardens
      ù----ù----ù----ù----ù----ù----ù----ù----ù----ù----ù----ù
Month: 6    7    8    9    1 0  1 1  1 2   1    2    3    4    5
      --Rainy Season- Cool, dry season ------- Hot, dry season
```

These sections are followed by an examination of livestock and its importance to concession economies. A subsequent section looks at the roles of other income sources to concession-level economies; namely remittances, or monies sent home by family members working abroad, and revenues from local employment. A final substantive section examines all of these "sectors" which contribute to the total concession economy and analyzes the interrelationships between them giving special attention to their impact on irrigated agriculture.

A final concluding section draws conclusions from the year's work and makes a number of recommendations for the project in general and for irrigated agricultural development in specific.

The Bakel Delegation is an area of environmental change. Drought began in the early 1970's and its impact has been nothing short of dramatic. With the exception of the younger portion of the population, people invariably recall the recent past when the area was well wooded, well watered, and supported an abundant variety of wildlife. Today great tracts of forest have been cut away and have not regenerated.

Farmers recalled that before the advent of drought it was common to produce three crops per year: rainy season cereals; "walo" crops or cereals planted in low-lying areas which retained rainy season moisture; and "falo" crops along the river banks and river bottom. This former abundance has been withdrawn, and options for agriculture are fewer. Irrigation has risen in importance, especially in the Soninke zones. Irrigation is now the central component in agricultural development in the area. This report examines its development as of the 1989-90 agricultural year; it identifies problems and offers solutions in the interests of such development.

The Sample Population

The sample is composed of 40 "concessions". Concessions are the basic unit of social organization and production in the Delegation. A concession is normally a large extended family made up of a number of nuclear family sub-units which are most easily identified by married women (and their children). These women are wives of a group of brothers. The oldest brother is normally the "chef de concession" or head of the concession. Physically the concession is a large compound within which the number of dwellings will vary according to the number of sub-units.

The sample was originally made up of 42 concessions but was reduced to forty. One concession at Ballou was deleted because the head of concession refused to cooperate with the data collector; a second concession at Naye was dropped from the sample because the head left for France. His dependents in this small concession were moved into the concession of a brother.

Each of the Delegation's four zones (Lower Goye, Bakel, Upper Goye, and the Faleme is represented in the sample. The distribution of the sample within the Delegation is shown in Table I along with the numbered series used to identify sample concessions.

Table I
Distribution of Sample Concessions

Zone:	Lower Goye	number	concession series
Village:	Diawara:	6	100
	Yelingara:	6	200
	Bakel Commune:	6	300
	Upper Goye		
	Aroundou:	6	400
	Ballou:	5	500
	Faleme		
	Naye:	5	600
	Guita:	6	700
	Total:	40 concessions	

With the exception of one sample concession at Bakel, the town and riverain communities in the Upper and Lower Goye zones are Soninke. The villages of Naye and Guita on the Faleme river are Toucouleur, a Pulaar or Fulfulbe-speaking people who also practice transhumance pastoralism.

The characteristics of the sample population are reviewed in Tables II-A (Soninke) and II-B (Toucouleur).

Table II-A
Soninke Concessions

Concession Number	Social Class	Concession Size	Number of Remitters	Non-Agricultural Occupation(s)
		Lower Goye		
DIAWARA				
101	Captif	24	2	manager pharmacy & petty commerce.
102	Noble	13	1	landlord, Dakar.
103	Noble	35	6	none.
104	Noble	39	2	landlord, Dakar; Arabic/Koranic school director.
105	Noble	16	2	landlord, Dakar.
ç106	Noble	16	*1	Marabout.
sub-totals:		(143)	(14)	(10 residents/migrant)

Table .I-A
Soninke Concessions
(continued)

Concession Number	Social Class	Concession Size	Number of Remitters	Non-Agricultural Occupation(s)
YELINGARA				
201	Noble	23	8	Chef du village.
202	Noble	28	7	Military pension.
203	Noble	13	10	boutique.
204	Noble	16	3	none.
205	Noble	22	3	none.
206	Noble	19	2	"Dioula"-trader.
sub-totals:		(121)	(33)	(4 residents/migrant)
BAKEL			Bakel Commune	
301	Captif	14	*1	masons (2).
302	Captif	11	1	woodworker.
303	Noble	35	4	boutique/commerce
304	Captif	9	0	laborer.
305	Noble	16	1	Marabout.
306	Captif	7	0	none.
sub-totals:		(92)	(7)	(13 residents/migrant)

Table II-A
Soninke Concessions
(continued)

Upper Goye

AROUNDOU				
401	Noble	31	2	mason, commerce.
402	Noble	19	1	mason.
403	Captif	7	*1	mason.
404	Noble	9	*1	none.
405	Noble	28	2	Marabout,Koranic school.
406	Noble	20	3	none.
sub-totals:		(114)	(10)	(11 residents/migrant)
BALLOU				
502	Noble	31	1	landlord, Dakar.
503	Captif	25	7	none.
504	Noble	11	*1	none.
505	Noble	22	7	none.
506	Noble	12	6	none.
sub-totals:		(101)	(22)	(5 residents/migrant)
Totals:		571	86	(7 residents/migrant)
29 Concessions, Avg:		20	3	per concession.

((* refers to a remitting immigrant who is not a concession member. These instances are counted in the above totals.))

Local society, both Soninke and Toucouleur, includes a number of castes and classes. The predominant class is the nobility, and it is usual to find that one noble family (or lineage) occupies the chiefship of a village or a major section of a village. This noble family may be associated through marriage with other noble families who are usually known as counsellors.

Another class is that of Marabouts, or religious specialists. Marabouts include the imams (Islamic leaders). They lead the community in prayer, provide Koranic teaching, and carry out the

ritual and liturgical aspects of Islam. Members of the Marabout class may be drawn from other classes.

A third group is made up of a number of castes: that of blacksmiths (forgerons) and artisans in general (such as leatherworkers). The artisans are technically (at least in an anthropological sense) a caste. Although all classes and castes are formally endogamous (must marry within their group), the social sanction against marriage with artisans is the strongest. Marriage to an artisan is unheard of in the villages and it is very rare in urban areas, even among more educated individuals. Traditionally artisans served the nobility through the production of agricultural implements, weapons, horse tack, pottery, and the like. In exchange they were largely fed from the grain stocks of noble families. In times of distress, this relationship is still used by people of this cast to obtain food.

A final general category is that of "captifs". Captifs are essentially captives or slaves. The members of this class are bound to the nobility through the provision of labor in exchange for food. The degree to which customary labor relations still prevail in the Delegation is not clear, but as with the artisans, individuals still resort to this customary relationship in times of distress.

The sample group is biased in favor of noble concessions. This is especially the case in the Lower Goye. At Diawara the predominant noble family, noble counsellors, and Marabouts of the Saudi-assisted Alfallah sect dominate the sample. At the time of sample selection, members of another group, the Khader sect, were not included because of their distrust of SAED and non-cooperation stemming from association with the Federation des Paysans Organise a Bakel. The Federation is an indigenous group which pioneered irrigation in the Bakel area.

It is anticipated that new samples to be selected for monitoring in 4 or 5 key villages in 1990-1991 will better reflect a true cross-section of local society. It is essential that future sample selection includes not only participation in irrigation, but also the concession's position in local social structure as a criterion for inclusion.

In spite of a tendency to examine households of the upper echelons of local society, there is a significant degree economic differentiation among sample concessions and it would be unwise to assert that social position is the only determinant of economic status. It is true that the upper classes have traditional rights to prime recession land along the river as well as tracts of good rain-fed land and "walo" land; but not all noble concessions are necessarily land rich. In recent years the phenomenon of going abroad to earn wages has added a new and highly significant component to the local economy. This infusion

of money from outside sources is not restricted to any one class or caste. To this degree, the sample does provide substantial and worthwhile amounts of information on concession-level economics which are of use to SAED and the T.A. Team.

The situation of the two sample communities of the Faleme is reviewed in Table II-B.

Toucouleur Concessions

NAYE				
601	Captif	8	1	transport/carter.
602	Noble	10	*1	fishing/laborer.
603	Noble	19	3	Marabout, trader.
604	Captif	6	*1	mason.
606	Noble	25	1	Chef de village.
sub-total:		(68)	(7)	(10 residents/migrant)
GUITA				
701	Captif	8	1	herder.
702	Noble	4	0	herder.
703	Captif	11	1	herder.
704	Noble	5	1	herder.
705	Noble	4	0	herder.
706	Noble	20	1	herder.
sub-total:		(52)	(4)	(13 residents/migrant)
Total:		120	11	(11 residents/migrant)
11 Concessions, Avg.		11	1	per concession.

A number of differences can be perceived between the Soninke and Toucouleur groups in the sample. These differences are summarized in Table III and discussed below.

Table III
Demographic Characteristics

	Soninke	Toucouleur
Total Population:	683	134
Residents:	571	120
Percent Resident:	84%	90%
Immigrants % pop:	16%	9%
Percent Remitting:	71%	69%
Avg. Residents/immigrant:	7	11
Avg. Concession size(no.):	20	11
Avg. Immigrants/concession:	3	1
Avg. Age of Concession Head:	54	44
Avg. No. wives of Conc. Head:	2	1
Avg. No. other married women:	2	1

Noteworthy from the above are the generally larger Soninke families (20 vs 11 members) and the greater age of Soninke concession chiefs (54 vs 44 years). Soninke concessions accumulate and retain more nuclear family units (indicated by the number of married women resident in the concession) than do Toucouleur concessions. Soninke concessions thus appear to have the advantage of size or scale by pooling and accumulating essential resources (capital and labor). The higher average age of concession among the Soninke suggests that concession units remain intact longer among the Soninke before older brothers leave to form their own concession. It may also reflect a higher number of immigrants among the Soninke who normally leave their wives in the brother's concession. This is seen in the average number of other married women in the concession and is further supported by the ratio of residents to remitting immigrants: about 1:7 and 1:11 for the Soninke and Toucouleur respectively.

II. Irrigated Agriculture

This section examines the sample concessions participation in SAED PIVs (Perimetres Irrigues Villagoises) through analyses of labor and capital allocation, crop production, and returns from irrigation.

Four of the sample communities irrigated rice during the 1989-90 hivernage period (Diawara, Bakel, Aroundou, and Ballou). Smaller quantities of irrigated sorghum and maize were also cultivated in the perimeters. Irrigators at Yelingara produced irrigated sorghum because of sandy soils which are not conducive to production of rice. Naye and Guitta did not participate in irrigated agriculture during this period.

A resume of relevant data collected on rice production by the monitoring system is summarized in Tables IV and V. Raw data are appended in annex 1.

Table IV
Rice Producers - Production

Village (no. conc.)	Av. Yield T/Ha.	Av. Plot Ha.	Total Area Ha.	Total Production Tonnes
Diawara (6)	2.36	1.37	8.24	19.4
Bakel (6)	3.75	0.69	4.14	15.5
Aroundou (6)	2.18	0.72	4.33	9.4
Ballou (5)	2.96	0.61	3.03	9.0
Average (23):	2.70	0.87	(19.74)	(53.3) (Total)

In spite of the fact that high yields, upwards of 5 tonnes per hectare, can be achieved for rice, the sample shows a somewhat more modest average level of productivity: 2.7 t./ha. These lower yields can be explained in large part by: (1) late planting of rice, because many producers did not turn to the perimeters until late in the rainy season after it had become apparent that their rain-fed crops would fail. Planting later in the season diminishes the benefits of heat and sunlight which are essential for high yields. (2) An invasion of insects had a negative impact on production. At Ballou, where pesticides were brought in, the yield was 2.96 t./ha. At Aroundou, where the yield was about one-third lower (2.18 t./ha.), wet conditions and washed out roads prevented the distribution of pesticides.

Bakel had the highest yield, some 3.75 t./ha. This is likely largely due to Bakel's participants putting a greater emphasis on rice because of the presence of generally good rice-growing soils in the Commune's PIVs. The town's access to pesticides which

were needed to combat an invasion of grasshoppers may also have contributed to higher yields.

Although the sample concessions abandoned irrigated agriculture at Naye and Guitta, field measurements and yields were recorded for the small (9-hectare) Naye I perimeter which was partially used during the 89-90 rainy season. Just over 1 hectare of the perimeter was irrigated. It was reported that there is a concave area of about 2 hectares in the middle of the perimeter which holds water and is conducive to rice production. Another area of about .36 ha. was used for irrigated sorghum for which a good yield was reported although the producer could not be found and interviewed as to the number of sacks produced. All plots put under irrigation were measured. (Irrigation at Guitta has been totally abandoned). The results from Naye were as follows:

Table V
Irrigation at Naye

Crop	Plot Area	Production	Yield
Sorghum	.3668 ha.	unknown	reported as good.
Rice	.1327 ha.	.400 t.	3.02 t./ha.
Rice	.1200 ha.	.0	7 irrigations, abandoned.
Rice	.1452 ha.	.0	5 irrigations, abandoned.
Rice	.1505 ha.	.231 t.	1.53 t./ha.
Rice	.3683 ha.	.0	3 irrigations, abandoned.
Rice	.1441 ha.	.385 t.	2.67 t./ha.
Rice	.1404 ha.	.616	4.39 t./ha.
Total:	1.33 ha.	Total Area Harvested: 0.9345 ha.	

Naye I began the season with a total irrigated area of 1.33 hectares of which rice accounted for some 0.97 ha. Abandonment of some rice fields resulted in an area of 0.57 ha. being harvested. The prime cause of abandonment given by informants was a lack of cash and credit needed to pay the fuel bill for irrigation water and inputs. A conversation with an individual who had abandoned his rice plot after seven irrigations revealed that he had simply run out of money. He indicated that he had roughly 30,000 F.CFA. per month from his brother working in France and that this money was needed to feed his family of 20 consumers. Hired labor is not possible given the family cash flow. Another brother who cares for the family herds (some 45 head of cattle) is not generally available to help with production. This too was a constraint.

This gentleman surmised that it was more worthwhile to sell a calf or two each year to purchase grain than to tie up scarce money and labor in the production of rice on a small plot of 0.12 hectare. His total rain-fed harvest was some 600 kg. of maize.

This obviously is but a small fraction of the annual cereals requirement for a family of 20 people. As a "notable" in the community (chef du village) the 30,000 F.CFA. monthly remittance was entirely used for subsistence not only for the family but to provide cereals to others in short supply. More light on the decision to abandon rice is provided in the analyses to follow in the section concerned with the economics of rice production.

As can be seen from the above table, yields of paddy vary considerably from a high of 4.39 tonnes per hectare for an individual who applied appropriate amounts of fertilizers to a low of 1.53 t./ha. in the case of an individual who applied less and apparently had some problems with irrigation.

Labor can be a constraint on production where significant numbers of household members have left to work abroad. The supply of labor and is an important determinant of the area which can be cultivated by the family. Informants frequently stated that the area under irrigation could be doubled or trebled and operated by the same contingent of labor if the levelling of land and the elevations of canals had been correctly done from the outset. The extent to which problems of land levelling (which was done by participant labor) and water conveyance can be resolved by the farmers themselves is currently under study by the Harza Technical Assistance Team.

Table VI shows the types and amounts of labor used in the 89-90 hivernage season for irrigated rice.

Table VI
Labor in Irrigated Rice

Village	A.	(%)	B.	(%)	C.	(%)	D.	E.	F.
Diawara	158	(84)	30	(5)	21	(11)	494F.	1.37	138
Bakel	189	(81)	41	(18)	3	(1)	1500F.	0.69	337
Aroundou	386	(92)	24	(6)	8	(2)	629F.	0.62	674
Ballou	303	(94)	6	(2)	12	(4)	239F.	0.61	531
Average	264	(89)	32	(7)	18	(4)	607F.	0.87	343

A. = Family labor in person-days.
B. = Unpaid or reciprocal labor in person-days.
C. = Hired labor in person-days.
(%) - Indicates percentage of total labor supplied to each category.
D. = Average price paid for labor: total expenditure divided by the number of person-days hired.
E. = Average plot size.
F. = Average number of person-days per hectare.

As can be seen from the above table, the great majority of labor is provided by the family; reciprocal labor is generally more important than hired labor. This is especially true at harvest time. Hired labor accounts for only 4 percent of the total labor in the sample of all rice producers. The highest proportion of hired labor is at Diawara, in the Lower Goye, where labor is reported to be in somewhat short supply. At Bakel and in the Upper Goye the supply of family labor less problematic. It is noteworthy as well that the average plot at Diawara is almost twice the size of those at Bakel and in the Upper Goye; in other words, the area with the highest percentage of hired labor is that which possesses the largest plots. This suggests that hiring labor is a stop-gap measure which is resorted to only when family / reciprocal labor cannot meet the need.

It is likely at Aroundou and Ballou, where very high amounts of labor per hectare are reported (Aroundou, 674 p-d./ha. and Ballou, 531 p-d./ha.), that the labor supply is in surplus to actual needs. Given the poor performance of rain-fed crops and the switch over to rice late in the rainy season, it is probable that surplus free labor was assigned to rice fields. This, in the context of small plot sizes, opens the question as to appropriate scales of production (ie: optimal plot sizes) relative to the domestic labor capacities of the concession or extended family. If indeed, labor was surplus to requirements for rice, it may well be the case that the marginal utility of much of the labor assigned to rice at Aroundou and Ballou was minimal.

Hired labor is obtained in two principal forms. The first is a type of migrant labor called sourga. In the Bakel delegation this normally refers to Malians who are fed and housed in exchange for three days of work per week. In the Lower Goye Malian migrants may reside in Soninke concessions for up to half of the year. The second form is direct hire, and this may include Malian sourga labor working outside the host household. Wages (according to an informants employing considerable numbers of workers) are currently about 1,000 F.CFA. per short day of 6 1/2 hours and 1,500 F.CFA. per full day. Data collected in the socio-economic survey (see Table VI) show lower rates of pay; this is explained by the inclusion of both sourga and daily wage forms of labor in the determination of the average daily wage. At Naye and Guitta and for the remuneration of work in other crops, wages can be lower, in the vicinity of 750 F.CFA. for a short day.

Purchased inputs appear to be widely accepted and used in the production of rice throughout the Delegation area. Purchases of inputs are summarized in Table VII below.

Table VII
Input Purchases
(in F.CFA.)

Village (no. of cases)	Value of input purchases/concession	Value/hectare of rice
Diawara (6)	45,669	33,276.
Yelingara (6)	8,817	(no rice)
Bakel (6)	41,435	40,082.
Aroundou (6)	48,597	67,331.
Ballou (5)	40,382	67,304.
Naye (5)	3,000	(no rice)
Guitta (6)	5,000	(no rice)

This table should be interpreted primarily as an indicator of the extent to which input purchases are related to rice area. The table thus shows the significance of inputs in rice producing villages (40,000 to 48,000 F.CFA) compared to non-rice growing villages (3,000 to 8,800 F.CFA.). A fully broken down list of inputs given to rice is provided in Annex 2.

During the first visit to the project, the author collaborated with Dr Robert Reeser on the development of an analytical system[1] for application to the PIVs which, among other things, shows the returns to labor and capital of irrigated crops under a variety of conditions.

The crop module portion of the analytical system was applied to data on rice collected from the socio-economic survey. The computer print-outs for these modules are found in Annex 3. Tables VIII-A, VIII-B, and VIII-C summarize findings from these analyses.

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[1] An Analytical Model for Irrigated Agriculture, Reeser, R.M. and Brusberg, F.E., Harza Engineering Co., Bakel, Senegal, December, 1989.

Table VIII-A
Returns to Rice Production
(in F.CFA. per hectare)

Village	Total Purchased Inputs	Total Product Value	Net Income per Ha.	Net Income Plot	Avrg. Plot Size	Avrg. Yield
Diawara	79,764	193,520	113,756	154,708	1.36	2.36
Bake	73,086	307,500	234,414	161,746	0.69	3.75
Aroundou	83,672	178,760	95,088	58,955	0.62	2.18
Ballou	72,054	243,540	171,486	104,606	0.61	2.97
Average	78,924	221,400	142,476	123,954	0.87	2.70

These returns or "profits" may also be expressed as kilograms of paddy, if from a subsistence perspective, paddy is used as the basis of reckoning production costs and benefits. Table VIII-B summarizes this for the sample villages.

Table VIII-B
Returns in Paddy
(in kilograms)

Village	Total Production	Net Return from Production	Net Paddy as % of Prod.
Diawara	3,210	1,888	59%
Bakel	2,588	1,973	76%
Aroundou	1,352	719	53%
Ballou	1,812	1,279	71%
Average	2,349	1,512	64%

Under this cost scenario, the case of Aroundou shows that when yields fall to about 2.2 tonnes per hectare, the equivalent of roughly one-half of the paddy harvested has a value equivalent to purchased production inputs. Bakel, with a yield of 3.75 tonnes per hectare, achieved the highest return; the equivalent value of only 24% of the harvest was needed to pay for purchased inputs.

These comparisons, based on applications of the analytical model, have held a number of factors constant. The most important of these is the cost of pumping irrigation water, which accounts in these cases for an average of 28 percent of total purchased input costs. The water cost module, shown in Annex 3, uses an average cost based on a basket of empirical and assumed factors. In this case, the variable water cost is set at 2.80 F.CFA. per cubic meter. The estimated fixed cost (an additional 6.40 F.CFA./cubic

meter) has not been applied as this would not figure in the producers' calculus. A total rainy season water requirement at the field of 7,800 cubic meters per hectare was used. Water conveyance efficiency is estimated at 75% (25% of water being lost). In most instances this is a low estimate of losses, but for comparative purposes this possibly optimistic estimate is used. Until more empirical information is available on losses in water conveyance during the next cropping year, these figures stand as temporary estimates.

Data from the analytical system's crop modules also provides measures of productivity for irrigated rice. These measures are summarized below in Table VIII-C.

Table VIII-C
Productivity Measures (Rice)

Village	Net Income / Per.-day of Family Labor	Net Income / Cubic Meter of Water	Paddy / Per.-day Fam. Labr.	Paddy / Cubic Meter of Water
Diawara	926 F.CFA.	15 F.CFA.	19 kg.	0.31 kg.
Bakel	703 F.CFA.	30 F.CFA.	11 kg.	0.30 kg.
Aroundou	144 F.CFA.	12 F.CFA.	3 kg.	0.28 kg.
Ballou	336 F.CFA.	22 F.CFA.	6 kg.	0.38 kg.
Average	433 F.CFA.	18 F.CFA.	8 kg.	0.35 kg.

As can be seen from the above, on the average, the return to family labor is well below the average prevailing daily wage. Daily wages in the sample villages are already significantly below prevailing rates as reported above. In all cases the net income to a cubic meter of water is well above the variable cost of water delivered to the field (2.80 F.CFA); with the exception of Aroundou, in the net income per cubic meter of water delivered is above the fixed and variable costs combined (12.92 F.CFA.). The average is some 18 F.CFA. per cubic meter.

Likewise the return to a person-day of family labor is another measure of productivity and profitability. At Diawara, for example, the net return to family labor (the net value of the crop divided by all family labor) is some 927 F. CFA. The value of the 19 kg. of paddy produced by a person-day of family labor is 1,558 F.CFA. In the average case (for all the sample) a 433 F.CFA. return on a person-day of family labor is to be considered alongside a 656 F.CFA. value for the 8 kg. produced. This latter calculation, which is in effect an expression of gross profit, may represent producers' logic in assessing the returns to irrigated rice cultivation.

The last productivity measure, kilograms of output per cubic meter of water, will be of use in comparing rice with other irrigated crops. This is the subject of the next section. A final and informative analysis in this section concerns the structure of input costs or the priority ranking of purchased inputs needed for the production of irrigated rice.

The above model applied to the average production scenario of the 23 sample producers in the socio-economic survey shows the following distribution and ranking of input costs per hectare:

1. Water purchase (var. pump cost)	= 27.7%	21,841 F.CFA.
2. Seed, fertilizers pesticides,etc.	= 55.7%	44,000 F.CFA.
3. Hired labor	= 10.6%	8,328 F.CFA.
4. Tools	= 6.0%	4,755 F.CFA.
Total	(100%)	78,924 F.CFA.

The value of total production from an one average hectare is some 221,400 F.CFA. (2,700 kg. x 82 F.CFA.) Water and other purchased inputs represent an expenditure of some 78,924 F.CFA. or 36% of the value of total production. It quickly becomes evident that if improvements are to be made, the areas of water cost and chemical inputs are prime candidates. Assuming that little can be done to reduce the price of agro-chemicals or fertilizers, attention will logically turn to water pumping, water requirements for crops, and conveyance costs. It would appear that water management is one factor which is clearly susceptible to technical improvements.

Noteworthy by its low rank is the cost of labor. Hired labor represents only 10.6% of total purchased inputs, and hired labor accounts for a mere 4% of all labor employed in production. Family labor (and to a lesser degree, reciprocal labor) account for 96 percent of production. Essentially, the family is working below the daily wage, but given the absence of other opportunities, returns appear to be a sufficient incentive to sustain interest in rice production.

The importance of irrigation as manifested in the allocation of labor is shown in Table XIV.

Table XIV
Labor Allocation to All Cereal Crops
and Groundnuts

Village Average	Total Labor P-Days	% Labor to Rice only	% Labor to all Irrigation (to Rain-fed)	
Diawara	2,667	43	69	(31)
Yelingara	1,739	30 (sorghum)	35	(65)
Bakel	2,547	55	55	(45)
Aroundou	6,245	54	55	(45)
Ballou	4,613	33	33	(67)

As noted, Naye and Guitta did not irrigate crops in 1989-90. Yelingara shows a low total labor expenditure for the sample concessions compared to others. This implies that sorghum, the most important irrigated crop, demands less labor. Conversely, the yields from Yelingara's sorghum fields were poor which may have been partially a result of low labor inputs.

In sum, the formula for rice production is abundant family labor and significant inputs of capital needed to provide water and chemicals. Enhancing the profitability of rice to a level which will surpass domestic consumption needs will involve a number of measures directed at improving productivity. As the system now operates, production is in large part sustained by the participation of farm families working at a reduced "wage" on the speculation that they can produce rice cheaper than it can be purchased on the market. In the average case above, if the 78,924 F.CFA. spent on purchased inputs was used to purchase paddy this would provide 963 tonnes. Net production was some 1386 tonnes or almost 70% more paddy than if no work had been done at all.

The application of the same costs and cost structure to Bakel, which had an average yield of 3.75 tonnes per hectare, is more encouraging. Expenditures for production were 73,086 F.CFA. which is equivalent to about 891 kg. of paddy. The take-home harvest value was 161,746 or 1,973 kg. In effect, the provision of some 333 person-days of unpaid family labor procured 1.97 tonnes of paddy at a cost of 37 F.CFA. per kilogram, a discount of 55% off the prevailing market price (82 F.CFA./kg.).

That farmers continue to produce rice by this system can be understood within the context of a subsistence-oriented economy. When questioned on the subject of subsistence production, informants invariably replied that they would like to be engaged in a type of agriculture which produced more than a portion of their food needs. However, given the significant demands of irrigated rice for capital, and the modest returns to labor, it is understandable that participation has been somewhat

restrained. The fact that a number of "groupements" remain organized and endeavor from year to year in spite of a number of physical and technical problems in the perimeters, attests to the vigor and aspirations of local participants.

Other Irrigated Crops and Irrigation Alternatives

Rice is the principal crop put to irrigation in the Delegation. Nevertheless, other crops were irrigated in the perimeters, especially where soils were not conducive to the cultivation of rice. (Rice is best cultivated on clay soils which retain standing water).

At Yelingara, where no rice was cultivated, sample concessions irrigated sorghum. Data collected in this community are shown in Table IX.

Table IX
Irrigated Sorghum
Yelingara

Concession No.	Area Ha.	Production Tonnes	Yield T./Ha.
201	0.5111	0.700	1.37
202	0.9989	0.600	0.60
203	0.5393	0.400	0.74
204	0.4318	1.188	2.75
205	1.3584	0.700	0.52
206	0.9440	0.600	0.64
Totals:	4.7835	4.188	
Averages:	0.7973	0.698	0.88

One field of irrigated millet was also produced by concession No. 204. This field of 0.3948 hectare provided 1.2 tonnes of millet with a per hectare yield of 3.01 tonnes.

In general, irrigated sorghum appears to have had limited success. This was reportedly due to poor irrigation, which was used mainly to supplement the rain. Rainfall was lower than average and the timing was irregular. Farmers tended to hold off irrigation in anticipation of rains that did not come. Irrigation was applied too late in most cases. The 1989-90 hivernage period was also stricken by attacks of grasshoppers which did considerable damage to crops.

In spite of these adversities, it is apparent that at least in the case of concession no. 204, irrigated sorghum and millet did produce substantial yields of grain. This along with sorghum

provided a total cereals production of some 2,388 kg. This family of 16 consumers would normally require a grain supply on the order of 2,300 kg. (See discussion below on subsistence requirements in section VI, Table XII). It appears in this case that the annual cereal need has been largely satisfied.

Plots of sorghum were also sown in the perimeter at Diawara (II). This perimeter has a number of problems with its canals, according informants. These problems, in the opinion of the Harza engineers, are related in part to an expansion of the perimeter area without enlargement or improvement of the canal system. As a result, priority was given to rice irrigation but by the time this was accomplished it was usually too late to effectively irrigate the sorghum. In effect, production and yields for sorghum in this perimeter should not be considered as those from irrigated crops because irrigation was neither timely nor sufficient. The average yield for the four sample concessions producing sorghum in the Diawara II perimeter was only 530 kg. per hectare. This is on par with non-irrigated yields in the area in 1989.

The sample contained a few irrigators of maize as well: 2 at Diawara and 1 at Aroundou. Yields were, at best, modest for irrigated maize, averaging 1.56 tonnes per hectare. The highest was some 3.77 t./ha. at Aroundou; the lowest was only .7 t./ha. at Diawara.

These mixed and generally low yields from "irrigated" sorghum and maize obviously fall well short of the agronomic potential of these crops. It appears that the obstacles to higher yields from the irrigation of traditional cereals involve one or more of the following:

(1) poor strategy on the part of farmers who waited too long in anticipation of rain before irrigating;

(2) technical difficulties with perimeter infrastructure, such as insufficient canal capacity, poorly levelled land, etc.;

(3) poor organization in the perimeters resulting in erratic pumping, late starts, etc.

These problems are compounded by the need for:

(4) more support for extension system activities; and,

(5) an effective institution for the provision of modest amounts of agricultural credit.

Traditional sorghums, millets, and maize can produce significant yields under irrigation using modest levels of inputs (compared to rice). The author has done research in Saharan oases where

yields of over 4 tonnes per hectare of irrigated millet (petit mil) are commonplace. Likewise, irrigated sorghum can produce yields in the 4 to 5 tonne/ha. range. Maize, as well, can provide similar or greater yields with adequate irrigation and inputs.

There are a number of perimeters and areas within perimeters which have soils that are not conducive to rice production. Such areas could be employed for the production of these traditional cereals. The principal cereals for home consumption are sorghum and millet. These grains are normally consumed at breakfast and in the evening meal. It is also the case that the Delegation area is a net importer of cereals; thus it stands to reason that production of traditional cereals would find a ready market in the region. Prevailing market prices for these cereals range from about 7,500 F.CFA. per 100 kg. to as much as 10,000 F.CFA. per 100 kg. sack depending on the time of year.

The analyses of irrigated agriculture provided in Dr R.M. Reeser's report (March, 1990) examine the profitability of such crops in the Bakel Delegation. Although the Reeser report is currently being written, it is not premature to assert that these crops are of significant interest. Water requirements are much lower and yields are substantial. Labor requirements are also lower than for rice. The sample average shows some 343 person-days for rice versus only 108 person-days for irrigated sorghum. Given the high cost of pumping and delivering irrigation water and the presence of soils which are too porous for production of rice in some perimeters, this alternative merits a thorough examination. The reader is advised to refer to this document.

III. Rain-fed Agriculture

As noted above, rainfall was slight and poorly distributed in 1989. Grasshoppers also took a significant toll. However, rain-fed cultivation still holds an attraction for producers given its relatively low demand for labor and insignificant needs for capital. Although the returns to rice production discussed above are somewhat optimistic, had rainfall been adequate for the production of rain-fed crops in the past rainy season, it is likely that the level of participation in irrigated perimeters would have been substantially reduced.

Table X shows the areas and proportions of cereal crops sown to both rain-fed and irrigated cereals in 1989-90.

Table X
Cropping Areas: All Cereals
Hivernage 89-90

(Hectares)

Village	Total Area All	Total Rain-fed Area (%)	Total Irrigated Area (%)	% Total in Rice	% Cereals Yield from Rain-fed
Diawara	21.13	7.16 (34%)	13.97 (66%)	39%	11%
Yelingara	11.26	6.08 (54%)	5.18 (46%)	n/a	25%
Bakel	9.82	5.80 (70%)	4.14 (42%)	42%	7%
Aroundou	7.84	3.93 (44%)	4.33 (56%)	55%	33%
Ballou	22.93	19.92 (87%)	3.01 (13%)	13%	62%
Naye	8.30		n/a		100%
Guitta	4.96		n/a		100%

Table X shows an approximately even split between irrigated and rain-fed land areas for Yelingara, Bakel, and Aroundou. In these cases the return in cereals from rain-fed cultivation was low relative to the much higher production from smaller irrigated areas. The only "exception" in the above is that of Ballou, where irrigated areas accounted for 87% of all cereals cultivated, where rain-fed crops accounted for 62% of all cereals harvested.

The above differences are accentuated in 1989-90 by the generally poor levels of production for rain fed crops. Rain-fed sorghum at Bakel and in the Lower Goye showed an average yield of 550 kg. per hectare for the 15 producers who actually harvested a crop. The average plot size was 2.3 ha.; the average expenditure of labor was some 83 person-days per hectare. (In this case three cases have been deleted because very small plots were given inordinate amounts of labor. This is likely a problem in reporting.) The average yield is inflated by three concessions

who had production in the 3 to 4 t./ha. range. Such yields can be achieved by sowing in depressions where the soil retains sufficient humidity to sustain the crop between rains. In many cases during the 1989-90 hivernage campaign, crops in such locations were lost to flooding. Paradoxically, in spite of generally poor rains, flooding was a problem where rain water collected in low spots after heavy showers. One should recall that from an agricultural standpoint, the timing of rains is also important. Even if the total seasonal precipitation is adequate for production, if it falls in a few heavy rainstorms with long spaces in between crops, must suffer both excessive inundation and drought.

Rain-fed maize was harvested by 22 concessions in the sample. Plot sizes were smaller than for sorghum, an average of .66 hectare. Yields were also poor, an average of 1 tonne per hectare. The average producer used some 145 person-days of labor per hectare; or 96 person-days per plot. Yields were generally higher in the Faleme and Upper Goye zones. Very little maize was planted and even less was harvested in the Lower Goye where rainfall was lowest.

A few fields of rain-fed millet were planted in the Faleme zone. Four fields were reported in the sample's 11 concessions in this area. No purchased inputs were used and 90 person-days per ha. was expended. Yields averaged some 830 kg./ha. The average plot size was .44 ha.

A final crop which merits inclusion is groundnuts. All the sample concessions in Lower Goye planted peanuts, and many added quantities of inputs (see raw data Annex 5). However, virtually all groundnuts sown in this area failed to produce. The only return from this effort was a supply of groundnut plants (leaves and vines) which were fed to animals. This crop is exclusively cultivated by women.

Women did harvest groundnuts at Bakel (2 cases) and in the Upper Goye and the Faleme. Average areas planted were extensive, given that they were cultivated principally by human labor. In two cases animal drawn ploughs were employed (at Aroundou and Ballou. An average of 190 person-days per hectare were spent in cultivation to produce an average yield of 920 kilograms per hectare. The average plot size was 1.36 hectares. The largest plot was 6.4 ha. at Ballou which produced 6.6 tonnes.

Groundnuts are important both from the standpoint of family nutrition, as a substitute for oil and protein, as well as an income source for women. A large sack (100 kg. rice sack) containing about 60 kg. of unshelled groundnuts sells for 4,500 to 5,500 F.CFA. in the village. Prices at Bakel are higher, between 6,000 and 7,000 F.CFA.

In conclusion, rain-fed agriculture gave poor harvests in 1989-90 in all zones of the Delegation. This underscores the need for alternative production systems that are characterized by higher levels of both labor as well as agronomic productivity. As long as rain-fed agriculture is at the mercy of highly variable annual rains (which appear to be increasingly poor and infrequent over the last three decades), irrigation will hold an attraction for local producers. However, this attraction is moderated by the fact that current irrigation schemes in the Delegation require substantial inputs of family labor and the assistance of immigrant-supplied cash for the purchase of inputs in order to achieve a modest harvest.

IV. Agricultural Production in the Dry Seasons

The months between the end and the beginning of the rainy season includes two periods or seasons: the cold, dry season ("contre-saision froide") and a hot, dry season ("contre-saison chaude") which begins in October-November after the harvest of rain-fed (djerry) crops. This cool dry period slowly gives way to a second, hot season, during which the heat reaches its zenith in the month of May. Afternoon temperatures at this time are in the mid 40's celsius.

Two agricultural options are open to the population during these periods. The first is recession agriculture ("falo") that takes advantage of the dry season drop in the levels of the Senegal and Faleme rivers which exposes moist land for cultivation. Planting begins on the banks, usually maize (corn) during the cool dry season. New crops are added as the water recedes and land along the river bottom is exposed. In some places crops planted on the slopes, are irrigated from shallow hand-dug wells as the dry season progresses.

Another form of cool dry season cultivation is known as "walo". Cereals (maize, sorghum, millet) are planted in low areas or "cuvettes" which retain water and humidity. None of the sample group cultivated in this way in 1989-90 because of low levels of rainfall.

The second agricultural option during the dry season is to irrigate in the Delegation's PIVs.

In both recession and irrigated agriculture, a number of crops are produced. Maize, and in one case, sorghum were sown on recession plots during the cold dry phase. Irrigated plots were planted in maize. Planting in recession fields along the river also began with maize and as the season progressed they typically included egg-plants, sweet potato, cow-peas (neibe) cabbage, melons, and gourds.

As discussed above, recession plots are normally planted in a number of crops. Crop densities vary as do crop mixes. Harvesting of eggplant, sweet potato, maize, and other products normally takes place over a period of many weeks. Vegetables are usually taken as needed for cooking. Some maize is harvested to be sold as green ears for roasting. Fully mature maize is later harvested as grain. This poses a problem in quantification.

Efforts were made to accurately assess production and yields from these problematical recession plots. It highly probable that the above estimates of crop values, which are based on reported harvests and prevailing prices from product sales data, are less than the actual value of crops. Given the problems which arise

in evaluating the output from recession fields, the use of net crop value as a measure of comparison was selected. This should not be taken to mean that all of production was marketed; indeed most of production was consumed locally. Only an estimated 10 to 15 percent of production is sold. In some cases however, where gourds were produced, most of the crop was sold. Gourds fetch about 1000 F.CFA. at the farm gate; a field with 100 mature plants represents a relatively large sum to the producer.
The wide range in per hectare crop values for recession plots reflects the types of crops grown, and to some degree, intensity of exploitation and the amount of labor devoted to the plot. Fertilizers were not used on recession plots to any significant degree and this cannot account for variances in crop values.
A tighter control of sample plots and more precise survey materials is anticipated for the next agricultural year. A detailed resume of the data used in this section is printed from Lotus 123 in Annex "4".

Table XI
Recession Fields Cultivated in the Contre-saison, 1990.

Village / Concession		Area Ha.	Estimated Net Value of Crops in F.CFA.	& in F.CFA./hectare
Yelingara	202	2.6990	177,600	65,802
	203	1.1275	96,600	85,676
	204	0.3759	131,600	350,093
	206	0.5243	21,600	41,198
Bakel	301	0.4986	59,690	119,715
	302	0.1883	5,650	30,005
	303	0.3313	71,053	214,467
Aroundou	401	0.0838	26,458	315,728
	402	0.3229	105,960	328,151
	404	0.1135	13,100	115,419
Ballou	504	0.1544	18,200	117,876
	505	0.2722	24,300	89,273
	506	0.5002	13,500	26,989
Naye	601	0.3104	14,097	45,416
	603	2.1236	284,760	127,350 (est)
Guita	701	1.0770	54,000	50,139
	702	0.2646	33,697	129,234 (est)
	703	0.2244	29,000	129,234
	704	0.4521	17,999	39,812
	Total:	11.6440	947,711	2,421,576
	Averages:	0.6128	49,880	127,451

Labor in recession production is almost exclusively provided by concession members. The total of 11.6 ha. cultivated by the sample concessions allocated some 1,547 person-days to these crops. Only 11 person-days of paid labor valued at some 7,050 F.CFA. were employed. This represents less than one percent of

the total labor allocated to recession fields. An average of 133 person-days per hectare were devoted to recession crops. Given an average plot size of about 0.6 hectare, this indicates an average family labor allocation of about 80 person-days per plot.

Assessments of net crop values can be used to establish a proxy (or substitute) measure of productivity for recession fields which is of use when comparing the with the production of similar crops in the Delegation's irrigated perimeters. Total expenditures for inputs in minimal, less than 5,000 F.CFA. for all 19 producers. Establishing net crop values for recession fields is thus based on multiplying known crop outputs by known crop values and subtracting the minimal input costs for seed, labor, and in one case a minuscule amount of fertilizer.

On the basis of the 19 producers listed in Table XI, the average plot of just under 0.6 ha. produced an average crop value of just under 50,000 F.CFA.; this is equivalent to an average value of about 127,500 F.CFA. per hectare. Dividing total production value by total labor shows an average of product value of just over 1,600 F.CFA. per person-day of labor.

All falo plots were planted in a number of crops over the season and maize was often intercropped. In a few cases however, the maize crop dominated and was measured separately. The data summarized in Table XII is based on reported harvests divided by measured areas.

Table XII-A
Recession Maize Yields

Concession No.	Area ha. .	Harvest tonnes	Yield t./ha.	
204	0.3759	1.260	3.35	
401	0.0838	0.225	2.69	
504	0.1544	0.270	1.75	
505	0.2722	0.405	1.49	
Totals:	0.8863	2.160	2.44	Average

Production from recession fields is essentially for supplemental subsistence production and might be best seen overall as kitchen gardens with a small component for market sales (ie: gourds, vegetables). Just under one-half of the sample concessions (19/40) worked such plots. Not all concessions have access to "falo" land along the river; but given its potential, it is probable that it could be exploited more intensively. Some cash crops are produced, such as onions, cabbages, gourds or calabashes.

The significance of falo cultivation is relatively minor when seen in the context of total land in production during the hivernage season. For the sample group as a whole, a total of 87 hectares were cultivated in the rainy season (56 ha. rain-fed and 31 ha. irrigated). Falo production of 11.6 ha. is a relatively small area compared to the previous season; it represents only about 13 percent of the total hivernage areas sown by the sample group.

However, recession cultivation's higher productivity per hectare makes it a relatively important component in subsistence. With a conservatively estimated product value of just under 130,000 F.CFA. per hectare it compares favorably with rain-fed cultivation which has an estimated value of about 53,000 F.CFA. per hectare (based on a 1989 hivernage average yield of 0.88 tonnes per hectare for sorghum). Although the 133 person-days per hectare are somewhat higher for falo than for djerry (110 person-days/ha.), returns to labor are significantly higher: about 1,500 F.CFA per ha. vs about 480 F.CFA. per ha. for rain-fed production.

The use of the Delegation's perimeters by sample concessions in the cool dry season is summarized in Table XII which shows areas cultivated and product value estimates.

Table XII-B
Cool, Dry Season Irrigation, 1990.
Maize

Village	Concession	Area Ha.	Estimated Net Value of Crops in F.CFA.	& in F.CFA./hectare
Diawara	105	0.0288	4,389	152,396
Ballou	504	0.1408	13,140	93,324
	505	0.1408	14,600	103,693
	506	0.1162	15,280	131,497
Totals:		0.7724	47,490	480,910
Averages:		0.2322	9,887	97,353

Four concessions in the sample produced irrigated maize which was sown in October. Yields were disappointing: between 2.1 and 2.8 t./ha. Concession 101, which had a yield of only 190 kg./ha. has been eliminated because it is clear that the plot was not irrigated, although it was sown in the perimeter. In all cases no fertilizers were applied and yields were averaged somewhat less than the recession plots 2.0 vs 2.4 t.ha. The average plot size was only 0.11 ha. and the average labor allocation was some 86 person-days. This is equivalent to 832 person-days per hectare or an average return of just over 1,600 F.CFA. per person-day of labor. These figures can only be said to be

indicative at best because: (1) the sample is very small; and (2) product values may be underestimated. Maize is sold as green ears at 3 per 100 F.CFA. Reported grain yields were inflated by one-third to account for sales of green ears. This proportion is an estimate based on interviews and data available on such sales. Maize has been converted into cash at the rate of 60 F.CFA. per kg. Sales of green ears will raise actual cash earnings. Nevertheless, given the relatively small sums involved and the complexities of converting green ears into cash, a straight conversion into grain will suffice to produce crop values.

The perimeters were also used to produce onions, and to a lesser degree vegetables like egg plants, cabbages. Planting begins as early as November and can continue until February. Six concessions produced onions and vegetables during this period. Onion production is summarized below in Table XIII.

Table XIII
Dry Season Irrigation, 1990.
Onions

Village / Concession		Area Ha.	Estimated Net Value of Crops in F.CFA.	& in F.CFA./hectare
Diawara	104	0.3926	59,999	152,825
Aroundou	401	0.9920	37,500	37,802
	402	0.1216	73,750	606,497
	403	0.1346	68,750	510,773
	405	0.0625	108,750	740,000
	406	0.0786	11,250	143,130
Totals:		1.7819	359,999	3,191,026
Averages:		0.2970	60,000	531,838

Onion yields are low ranging from less than one tonne to just over 7 tonnes per hectare. This is in some cases due to the presence of egg plants and other crops in the plot. As with maize, production values can only be said to be indicative of profitability and productivity. Labor allocation shows an average of 148 person-days per hectare for these onion plots. The average plot of 0.3 ha. was given some 44 person-days. The return in crop value per person-day was almost 13,400 F.CFA. In the case of one plot which yielded 7 t./ha. of onions the return in crop value was 29,500 F.CFA. per person-day. There is little doubt that onions and vegetables can be very profitable. Onion yields found here are modest; given that they can attain levels upwards of 40 t./ha. the implications are significant.

The sample of irrigated plots during the contre-saison is very small, only 10 of the 40 concessions. Table XIV aggregates all of these plots to give a general comparison of irrigated and recession plots during the dry season.

Table XIV
Summary of Recession and Irrigated Crops
Contre-Saison, 1990.

	Recession	Irrigation
No. Producers:	19	10
Total Area:	11.644 ha.	2.085 ha.
Average Area:	0.545 ha.	0.201 ha.
Net Product Value per person-day labor:	1,600 F.CFA.	8,800 F.CFA.
Percent of all land cultivated in 89-90:	8%	1.6%
Avg. Production Value:	127,350 F.CFA/ha.	367,200 F.CFA/ha.
Avg. Production Value:	51,800 F.CFA.	40,700 F.CFA.
Avg. Labor allocated:	82 person-days	62 person-days
Person-days/ha:	133	280

A comparison of recession and irrigation is worthwhile inasmuch as recession land is likely to be the most competitive local agricultural resource with irrigation. Recession cultivation is certainly more productive in terms of land and labor when compared to rain-fed djerry fields. Even a liberal estimate of 1.5 t./ha. of rain-fed sorghum in a good year would yield a product value of some 90,000 F.CFA. It is certain that harvests from the falo plots were under-reported because harvesting takes place over a period of weeks as products are needed for the kitchen; yet in spite of this, recession plots produced an average product value of almost 130,000 F.CFA. per hectare. It appears that recession agriculture is an important component in subsistence for villagers along the Senegal and Faleme rivers. The importance of recession cultivation could be expected to rise in poor years for rain-fed crops. This relationship can be examined as data becomes available in future years. No discernable difference in recession plot size was found between villages on the two rivers: the average area on the Faleme is 0.52 ha.; on the Senegal it is 0.55.

Table XIV clearly shows that irrigated plots have much higher productivity compared to recession plots: irrigated plots produce over 5-times the product value per person-day of work and almost three-times the net product value per hectare in spite of seemingly mediocre yields for irrigation. Given this superior productivity and production potential, why did so few of the concessions engage in irrigation during the dry season?

Irrigation requires about twice the labor per hectare when compared to recession fields; but the constraint of labor does not appear to be significant at current production scales or even at considerably higher scales of production. Capital needs for falo are minimal: an insignificant expenditure of about 500 F.CFA. per hectare was spent on recession fields. Expenses for

irrigated plots averaged just over 13,500 F.CFA. per hectare; the average producer spent some 3,140 F.CFA. Although input costs (obviously including water) are higher, an expenditure of 13,500 F.CFA. to produce an estimated product value of over 350,000 F.CFA. cannot be seen as a strong disincentive to raising the level of dry season irrigated production in the Delegation. Yet discussions with farmers throughout the area invariably hinge on the subject credit needed for inputs and irrigation water.

A number of steps can be taken to answer the question of inhibitions to greater contre-saison production in the perimeters. These steps are: (1) verify the data on production costs and product yields; (2) ascertain the importance of labor and capital constraints to production; and (3) look at "groupement" organization, especially as concerns land allocation, the amount of easily irrigable land available and problems with water conveyance.

A fourth item which will inevitably come into play is the question of marketing or disposal of production. This raises the critical issue of producer cooperatives or producer organizations which are essential village-based institutions for input supply, motor pump and perimeter maintenance, credit and marketing. These problems can and will be resolved, and this must be undertaken through direct and continuing dialogue with producers.

V. Pastoral Production

Livestock populations were counted during the 89-90 agricultural year as one element of the larger strategy of tracking all sources of income for sample concessions. Although the T.A. team is essentially concerned with agriculture, livestock like any other source of income may figure in economic strategizing at the concession level. In addition to their economic value, cattle, horses, and to a lesser extent donkeys, have a role in agriculture as traction animals. Two surveys were undertaken: the first was in December-January; the second was carried out in June-July. Livestock data for the sample are shown in Tables XV-A and XV-B which summarize data provided in Annex "5".

Table XV-A
Livestock Populations
Soninke Villages and Bakel Town
(29 concessions)

	December-January		June-July		
	No.	avg.	No.	avg.	% change
Donkeys:	62	2.1	59	2.0	- 5%
Horses:	23	0.8	17	0.6	-26%
Cattle:	190	6.6	109	3.9	-43%
Sheep:	325	11.2	247	8.5	-24%
Goats:	86	3.0	76	2.6	-12%

Poor rains during the past hivernage and the subsequent shortage of pasture during the dry season is apparent from the above. The data is not surprising. The percentage change rates approximate losses in order of each species resistance to drought. Horses and cattle clearly had the highest percentage losses: over one quarter of horses and over two-fifths of cattle were lost in the first 6 months of this year. Horses are generally less resistant to drought than local cattle, but their value and care within the confines of the concession likely assure them better nutrition than cattle which forage on the range.

The traditional patterns of transhumance have been severed since the outbreak of hostilities between Senegal and adjacent Mauritania. Losses of cattle on the other side of the river were substantial, but the above data does not include cattle lost in this way. Such losses took place well before the December-January enumeration. Peul herders who have fled into the vicinity were reportedly paid 5,000 F.CFA. per head recuperated from the Mauritanian side by Soninke owners. The "repatriation" of cattle has greatly diminished in recent months and cattle which have been returned in this way are included in the above data. In spite of this, cattle data still show a significant decline.

Among small ruminants, sheep which are not highly resistant to drought, showed losses of almost one-quarter the number recorded for this species. Losses reported slightly exceeded the numbers sold or consumed for the annual sacrificial slaughter at the Feast of Tabaski. Goats are a hardy and drought-resistant species. Losses of goats are not dramatic and likely reflect increased consumption as grain stocks dwindle.

The slight decline in donkeys may in part reflect harsh pastoral conditions, but one informant in the Lower Goye did remark that since the Peul had moved into the area he had not seen his donkeys. The number of head per concession remained stable at 2 animals.

Informants generally reported mortalities from sickness. Minimal nutrition weakened the animals and their poor condition made it easy for disease to overtake them. Although no systematic research was undertaken on this matter, it was commonly reported that cattle drinking from polluted pools of rain water around the towns and villages in recent weeks is one important vector of botulism poisoning (known in Pulaar as "lathie"). Another endemic problem for cattle, especially the zebu herds displaced from Mauritania, is trypanosomiasis carried by the tse-tse fly (known in Pulaar as "dasou"). In recent weeks on trips to the sample villages dead cattle (and to a lesser extent small ruminants) are a frequent reminder of these diseases along the bush tracks, around the villages and in the outskirts of Bakel town.

The situation in the Faleme zone is set out in Table VIII-B.

Table VIII-B
Livestock Populations
Toucouleur Villages - Faleme
(11 concessions)

	December-January		June-July		
	No.	avg.	No.	avg.	% change
Donkeys:	9	1.5	7	1.2	-22%
Horses:	0	0	0	0	
Cattle:	158	26.3	142	23.7	-10%
Sheep:	79	13.2	77	12.8	-13%
Goats:	73	12.2	57	9.5	-22%

The Faleme zone generally receives more rainfall than the Soninke zones. Kidira on the Faleme reported 763 mm. in 1989; Bakel recorded 379 mm. and Diawara in the Lower Goye received some 328 mm. This indicates generally better pastoral conditions in the Faleme region with conditions declining as one goes downstream to the Upper Goye, Bakel, and the Lower Goye.

The sample of donkeys is too small to merit analysis. (A loss of two head in 9 is not statistically significant; although in this case it is known that one animal was sold and one was "lost").

Losses of cattle are much lower in the Faleme than in the Soninke zones. The data for all species shows losses which can likely be overcome through reproduction in the hivernage period. The decline in goats is most probably a result of increased consumption. This area has a lower remittance income per capita and one village has a highly precarious level of cereals production per capita; as will be seen from analyses to follow based on Table XVI, the importance of livestock is much more important to Toucouleur subsistence and household economies than is the case in the Soninke communities. Table XVI is based on data found in Annex "5".

Table XVI
Livestock Revenues
(in F.CFA. X 1000)

Village	Total Sales (Average)	Livestock Sales (Average)	% Livestock Sales
Diawara:	158 (20)	0	0%
Yelingara:	366 (61)	190 (24)	52%
Bakel:	125 (20)	0	0%
Aroundou:	716 (119)	378 (63)	53%
Ballou:	147 (82)	82 (16)	56%
Naye:	383 (77)	230 (46)	60%
Guita:	778 (130)	506 (84)	65%

In the above table, "Total Sales" is the sum of all products, both agricultural and pastoral, sold by the village sample group. An average concession sales figure is obtained by dividing total sales by the number of concessions in the village sample. The same procedure is repeated for livestock sales. The column on the right side of the table shows livestock sales as a percentage of total sales.

It is well known that livestock is an important resource in Sahelian Africa. Remittance funds are frequently invested in the purchase of herds which serve as a form of savings bank for both sedentary and pastoral peoples alike. The value of different species varies somewhat from year to year as well as over the year. Data collected from interviews and from sales in the recorded in the monitoring program do provide a good estimate of current livestock prices.

(1) Cattle: a healthy cow 3 years of age is worth about 30,000 F.CFA.; at 4 years of age the value can rise to as much as 60,000 F.CFA. A year old cow is valued at about 20,000 and a year old bull about 15,000 F.CFA.

(2) Horses: a good horse can sell for up to 200,000 F.CFA. A yearling is worth at least 125,000 F.CFA.

(3) Donkeys: these creatures are abundant, a robust adult is valued between 15,000 and 20,000 F.CFA.

(4) Sheep: A female in good condition is worth between 25,000 and 30,000 F.CFA. A full grown ram is worth about 40,000 F.CFA. after the Feast of Tabaski; his value rises to about 60,000 F.CFA. in the weeks before the Feast. A lamb can be bought for as little as 7,500 F.CFA.

(5) Goats range from 3,500 to 7,500 F.CFA. for average specimens; an exceptional animal may sell for as much as 15,000 F.CFA.

A measure of this bank of livestock capital can be made by applying these values to the average livestock holdings for Soninke and Toucouleur communities. For the sake of simplicity, decimals have been rounded-off and values have been kept conservative.

Table XVII
Estimated Herd Values
Soninke and Toucouleur
(Average Concessions)

(F.CFA.)

Species	Soninke			Toucouleur		
Donkeys:	2 X 15,000	=	30,000	2 X 15,000	=	30,000
Horses:	1 X 150,000	=	150,000			0
Cattle:	7 X 40,000	=	280,000	26 X 40,000	=	1,040,000
Sheep:	11 X 30,000	=	330,000	13 X 30,000	=	390,000
Goats:	3 X 5,000	=	15,000	12 X 5,000	=	60,000
Total:			805,000			1,520,000

This table shows that in both cases livestock represents an important form of savings and revenue. Bearing in mind that Soninke concessions average some 20 people, this gives an average livestock assets value of about 40,000 F.CFA. per capita. In the Toucouleur area, where concessions average 11 people, the asset value per capita from livestock is significantly higher: about 138,000 F.CFA.

One observes in the preceding table (Table XVI) that the pastoral percentage of total product sales increases as one goes up the Senegal and into the Faleme river. This is largely due to the improvement in climatic and pastoral conditions as one travels upstream.

The extent to which livestock sales are related to overall concession subsistence requirements is shown below in Table XVIII which compares the degree to which sample concessions met subsistence cereals needs in the rainy season with livestock sales. This analysis assumes that most or all of livestock sales are directly or indirectly aimed at satisfaction of subsistence needs.

Table XVIII
Cereals Subsistence
and
Livestock Sales

Village	Cereals Satisfaction from Production %	Livestock Sales as % Total Product Sales
Diawara:	91	0
Yelingara:	59	52
Bakel:	85	0
Aroundou:	69	53
Ballou:	162	56
Naye:	36	60
Guita:	114	65

The above table is a somewhat rough measure. Nevertheless, it does yield some general observations. In the Lower Goye, Diawara which came close to meeting local subsistence needs from hivernage production (and could presumably achieve them in the contre-saison) had no livestock sales. Admittedly, the Lower Goye had a high rate of animal mortality; but some sales would be expected. At Yelingara, where hivernage production fell over 40 percent short of subsistence, livestock sales account for over half of product sales in the contre-saison.

Bakel, as will be seen in the next section, is a special case which enjoys some of the benefits of an "urban" economy. Bakel had no livestock sales reported in the sample (apart from one individual who sold about 4,000 F.CFA. worth of poultry). Bakel concessions were close to meeting subsistence satisfaction at the end of the hivernage with 85 percent.

The Upper Goye shows a similar pattern at Aroundou where hivernage cereals production was about two-thirds of subsistence needs, livestock sales were just over one-half of total product sales. At Ballou there appears at first to be an anomaly. Hivernage production was 62 percent over subsistence, and livestock sales accounted for 56 percent of total product value sold. However the actual value of all sales was very low. At Aroundou the total sales for the sample group was some 716,000 F.CFA. with total livestock sales of 378,000 F.CFA. per

concession. At Ballou total product sales amounted to 147,000 F.CFA. and livestock's share was 82,000 F.CFA.

The Faleme zone villages of Naye and Guita also show a strong relationship between hivernage cereals production and contre-saison sales of livestock. At Naye where hivernage agriculture produced only about one-third of estimated cereals subsistence needs, livestock sales accounted for 60 percent of total product sales. Guita is another apparent anomaly. Here rainy season production of cereals exceeded subsistence by 14 percent; livestock sales at Guita also show the highest proportion of total product sales at 65 percent. The "trend" is further countered by the fact that at Guita average product sales are over one and one-half greater than at Naye and livestock sales are roughly twice Guita's. The case of Guita can be better understood in light of the fact that this community has an average out-migrant remittance intake of only 25,000 F.CFA. per concession. Naye's average annual remittance per concession is on the order of 227,000 F.CFA.

It is evident from the above that the Faleme (Toucouleur) zone sells more livestock because of a richer pastoral resource. The data presented in this section shows that sample concessions employ available resources to attain subsistence ends. In the Faleme, where remittances are low, the pastoral resource has a greater significance than in Soninke zones where agricultural production and remittances are generally higher.

In all cases, livestock is a local resource used rather like a mobile savings account from which interest is drawn mainly for subsistence needs. The above analysis was undertaken on the basis of only two variables on the assumption that local production of all types is oriented to meeting subsistence needs first. It appears that this notion is likely true. Other income sources that contribute to overall concession budgets are the subject of the next chapter which begins with the most significant of all: remittances from villagers who have gone abroad through wage-labor migration.

VI. Immigrant Remittances and Concession Revenues

To this point the report has examined the principal forms of local production: agriculture (irrigated, rain-fed, and recession) and livestock. This section examines the most important single item in the sample concessions' portfolio of revenues: immigrant remittances. Among the sample concessions, the importance of money sent home from abroad accounts for between 50 and 90 percent of total household revenues from all sources. As was shown in the earlier section on irrigated agriculture, remittances are instrumental for the purchase of inputs and for paying for irrigation water.

Annex "6" shows all revenue sources by concession over the entire July, 1989 - June, 1990 monitoring period. A summary of these sources on a village by village basis is given in Table XX which provides a general image of the economic status of the average village concession.

Table XIX
Revenues - Average Village Concession
(F.CFA. X 1000)

Village	Total	Remittances	Employment	Products
Diawara:	1,853	585 (32%)	1,256 (68%)	12 (1%)
Yelingara:	877	791 (90%)	24 (3%)	61 (7%)
Bakel:	443	258 (58%)	164 (37%)	21 (5%)
Aroundou:	338	219 (65%)	0	119 (35%)
Ballou:	554	343 (62%)	181 (33%)	29 (5%)
Naye:	416	227 (55%)	112 (27%)	77 (18)
Guita:	211	25 (12%)	58 (27%)	130 (61%)
All:	680	353 (52%)	262 (39%)	65 (9%)

Remittances take three main forms: direct money transfers (mandats), credits with merchants, and direct shipments of food to villages organized periodically by immigrants. The above category "remittances" includes all such forms or transfers from immigrants to home villages. In cases where bulk grain was supplied, for example, the purchase value of the grain was used for conversion.

"Employment" is a mixed category; in effect it is a catch-all for revenues which do not come from migrants or local agricultural and pastoral production. This category contains a number of forms of employment: masons, woodworkers,laborers, people engaged in various forms of petty trade, pensioners, and in the case of Guita all concessions had one member employed as a hired herder. This latter occupation is not listed as earnings from pastoralism which is confined to livestock sales.

One very significant item included in this category is rents from property. At Diawara three chefs de concession have houses at Dakar. Two such landlords receive over 1,000,000 F.CFA. per year; one earns annual rents on the order of 5,000,000 F.CFA. This raised Diawara's total annual intake of revenues to about 1,850,000 F.CFA. which is twice that of the nearest competitor (Yelingara) and almost 9-times that of Guita, the sample's poorest village.

One concession head at Ballou has a house at Dakar which yields an annual rent on the order of 800,000 F.CFA. In these two communities, especially in Diawara, the effect of such large revenues has the effect of increasing the significance of this category; this imposes a slight reduction in the relative importance of the remittance and product sales categories for the sample as a whole.

The category, "products" is the sum of agricultural and pastoral production reported as sold. As is evident from Table XVIII, with the exception of Diawara and Bakel, livestock sales accounted for between one-half and two-thirds of total sales from local production.

A means of examination and analysis of these three income sources is provided below in Table XX.

Table XX
Percapita Revenues and Remittances per Immigrant

(X 1000 F.CFA)

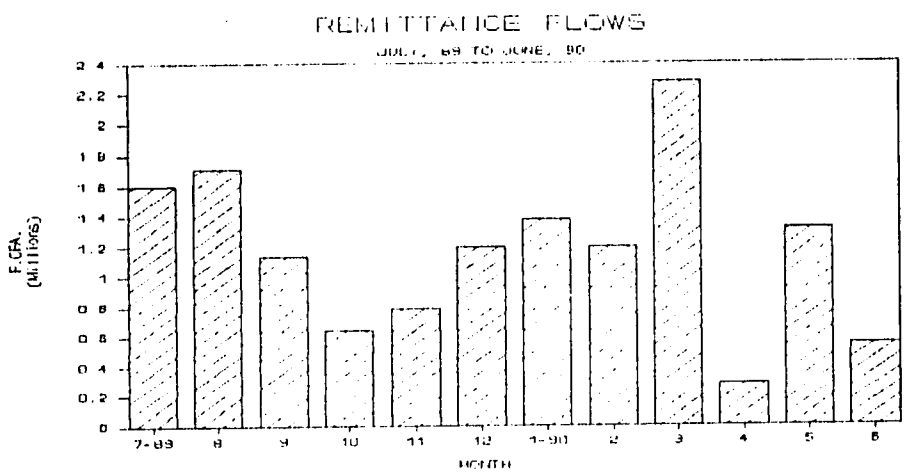
Village	All Avg.	Remittances Avg.	Employment Avg.	Products Avg.	Remit. / immig.
Diawara:	77.8	24.6	52.7	0.5	250.7
Yelingara:	43.5	39.3	1.2	3.0	143.9
Bakel:	28.9	16.8	10.8	1.4	245.0
Aroundou:	17.8	11.5	0.0	6.3	131.5
Ballou:	25.0	15.5	8.2	1.3	78.0
Naye:	30.6	16.7	8.2	5.6	162.4
Guita:	24.4	2.8	6.3	15.0	36.9
All:	38.8	20.1	14.9	3.7	145.6

Revenue sources are expressed as averages per resident (percapita): the total value per category per village divided by the number of residents in all concessions. Remittances per migrant are shown along with these percapita averages.

employment category by about 6 million F.CFA. If a rough median figure of 8,000 F.CFA. is substituted for rents in the employment category, the remittance share of all income sources from at Diawara rises from 32 to 97 percent. The sample's average revenue from employment declines to just over 4,000 F.CFA. per capita from the 14,900 F.CFA. shown above in Table XIII. Under this scenario, the average revenue per capita from all sources combined at Diawara drops to 25,255 F.CFA. from the 77,800 F.CFA. shown above. In sum, the impact of Dakar rents on percapita revenue is a three-fold increase. The rent data is not omitted, but its effects should be noted.

The degree to which remittances and other sources of income are related to irrigated production discussed in the section on irrigated agriculture. The interplay of irrigated agricultural production with other sources of income, especially remittances was discussed in the section on irrigated agriculture. It was shown that irrigation is successful to the degree that unpaid family labor is used and migrant remittances are available to finance expenditures for inputs and irrigation water. This contention is supported by an examination of remittance flows over the monitoring period which are shown in the figure below.

Figure II



The total amount of monthly remittances for the sample's 40 concessions reached 1.6 million F.CFA. in July, and 1.7 m. F.CFA. in August. This period is characterized by low cereals stocks and is the year's most active period. Rain-fed cultivation is

underway and land preparation for irrigation is normally begun at this time. This makes remittances essential. Another high point is observed during the months of December and January (1.2 and 1.4 million F.CFA. respectively). This confirms monitoring data which shows that remittances arrived to cover fuel and input costs owed to groupements at the end of the campaign. Two other significant peaks are seen: in March there is an influx of remittances (some 2.3 million F.CFA.) for expenses during the all-important Islamic month of Ramadan. Remittances climb once again during the month of May when purchases of sheep and other necessities rise dramatically in anticipation of the Feast de Tabaski.

Under a production scenario in which irrigation is not profitable to the degree that the majority of producers can use hired labor and are dependent on family labor, it is unlikely that production can be expanded beyond limits largely defined by the labor capacity of the family or concession. It is noteworthy that Soninke concessions, which average some 20-odd members have an advantage over Toucouleur concessions (average 11 members) in this regard. This is further qualified by the necessity of remittance money to underwrite production costs. Rice so produced, on average, gave the farmer the equivalent of a 55 percent discount on the market price. Noteworthy as well is the fact that rice is a labor-intensive and water-intensive crop which needs significant amounts of inputs to raise productivity to a level which will give the farmer a reasonable return on his labor.

If irrigated production is restricted to the labor capacity of the concession, there is little hope that its role can go beyond subsistence. This poses a problem if a more commercialized type of production is to be achieved involving local small farmers. Only two of the sample communities surpassed subsistence requirements for cereals in the last hivernage. Guita produced 104 percent entirely from rain-fed fields. Ballou, which was the most productive sample community, achieved 162 percent of subsistence in hivernage cereals of which only 38 percent were irrigated. Diawara, which had the best irrigation performance, achieved 91 percent of subsistence with 89 percent irrigated.

As long as irrigated production remains a fraction of subsistence, and an even smaller fraction of total household revenues, it cannot be claimed that significant development has taken place. Analyses have shown that the sample villages with the highest participation in irrigation have the high numbers of migrants and high remittance revenues. The only exception to this is that of Yelingara which has a number of physical or infrastructural handicaps: very poor or inefficient water distribution infrastructure as well as sandy soils. The fact that Yelingara had the highest remittances per concession was likely instrumental in keeping an inefficient perimeter in

production. Rainfall in the Yelingara-Diawara was mediocre and poorly timed during the 1989 hivernage; this undoubtedly helped to encourage irrigation. At Guita, where remittances are a mere 24,000 F.CFA. per concession the population took advantage of higher rainfall to produce djerry crops and tend herds.

Diawara, which had by far the highest level of remittances per concession also produced the most from irrigation. Aroundou, and Ballou both show incomes which correspond in rank with irrigated production. Livestock sales rise in an inverse relationship to the level of output from hivernage irrigation production.

In conclusion, it is evident that irrigation in the past agricultural year remained confined within the framework of subsistence. It is largely supported by financial aid from immigrants living abroad who see it essentially as a food subsidy (estimated at about 55 percent the market price for rice). The work to be undertaken by the T.A. Team over the next few years will focus on moving irrigated production out of this framework into a subsistence-surplus situation which is the first step towards a sustainable commercial form of agriculture that can be adopted and replicated by an expanding population of small farmers.

V. Conclusions and Recommendations

This report is the product of one year's work with a sample of 40 extended family households representing over 800 individuals. The socio-economic monitoring system is intended to measure project impacts as a retrospective device; but it also serves for forward planning by identifying constraints and opportunities.

The year's data show a number of findings concerning the characteristics of the sample population and participation in irrigation.

Work undertaken with Dr. R.M. Reeser on the basis of data collected by the monitoring system has clearly shown that current levels of profitability and productivity are generally too low to promote significant growth in production. It is reasonably clear from the data that the relatively high investment costs in irrigation (mainly fuel and inputs) are a deterrent to the involvement of households with low revenue portfolios. A positive relationship between remittances and irrigation, as expressed in hivernage production and in the use of the perimeters during the rainy-season has been found.

Confinement of production to the capacity of family labor is a determinant of production scales. In general, these scales appear to be below family labor capacity. The data shows that Soninke concessions have an advantage of larger size over the Toucouleur concessions. Toucouleur concessions also have lower remittance levels per capita than do Soninke concessions. The revenue portfolios of Soninke and Toucouleur concessions show some interesting differences: the Diawara sample had an average concession income of about 1,850,000 F.CFA. during the last 12 months. Some 32 percent of this came from remittances; 68 percent from employment; and only 1 percent from products. Guita, on the Faleme, is the poorest village in the sample, an average concession total of only 211,000 F.CFA. of which 12 percent came from remittances; 27 percent came from employment; and 61 percent came from products. The average for all sample concessions was some 680,000 F.CFA. this past year. Remittances accounted for 52 percent; employment contributed 39 percent; and products only 9 percent. This "average" situation indicates that the great bulk of production, both agricultural and pastoral, is used for subsistence ends.

The monitoring data also show significant "capital" reserves of livestock. Soninke concessions averaged about 127,000 F.CFA. worth of livestock; Toucouleur concessions averaged just over 320,000 F.CFA. Losses of the most valuable species, cattle and horses, were significant this year in the Soninke zones. This no doubt has put a strain on the subsistence economy.

Looking ahead, the fact that irrigators already apply revenues

from remittances to irrigation is encouraging and underscores the local need for more reliable and productive agricultural resources. The T.A. Team has applied a considerable and coordinated effort to the development of a strategy for meeting this need over the past year. Dr. Reeser's work with the economic model has identified a number of profitable cropping systems in collaboration with the project agronomist. A number of improvements in water conveyance efficiency and infrastructures have been developed by the Team's engineers. Monitoring in the next year will likely show changes in the composition or structure of concession-level economies. It is reasonable to anticipate that these changes will be positive.

Summary of Findings: Constraints

The summary below is based on findings from the monitoring activity over the past year. A series of meetings were held with the heads of survey households in order to thank them for their participation and to review these findings with them. Meetings with the sample groups concurred with the findings. Four general problems are identified and listed in order of magnitude.

1. The production of irrigated rice necessitates high investment costs for inputs and water. If sufficient inputs and water are not provided, crop yields will fall as will profitability. Low yields this year are directly related to a lack of credit which is essential for achieving such yields. Farmers were well aware of low yields in the past year and attributed this primarily to a lack of credit and input supply problems.

2. Parcel size or production scales are a function of available family labor. At current levels of productivity, hired labor is not generally possible for the great majority of farmers engaged in irrigated rice production.

3. Immigrants underwrite irrigated production costs to the extent that it reduces global subsistence needs. Migrants are reticent to contribute to more risky ventures which may incur debt.

4. Rice parcels are small and generally fall short of areas which could be cultivated by available family labor. Available family labor could, in general, farm larger areas of irrigated rice land even without the introduction of productivity-enhancing technologies or improvements to water conveyance and land levelling problems which divert labor from the fields.

Discussions with farmers has shown that they are well aware of the situation. They asserted that they would like to have a profitable form of agriculture, but for the time being they are engaged in a struggle to meet subsistence demands. They hope

that if subsistence needs can be achieved there will be scope for agricultural production which brings them profits.

At present they are caught in a vicious circle. Low supplies of capital mean low yields. Low yields mean diminishing returns. As the situation now stands, with average yields under 3 tonnes per hectare, production with free family labor essentially subsidizes the price of rice that would otherwise have to be bought on the market.

Given the high demand for inputs and water for rice, more and more farmers are looking to other cereal crops (millets, sorghums, and maize) which give more grain per unit of irrigation water, require less fertilizer and other inputs, and require less labor. Farmers frequently requested improved seed for these cereals.

The situation as it now stands is not a good one. The farmers feel trapped by high water costs, a lack of credit, and low yields. The Bakel Delegation is situated on the front line of an ecological disaster. In many areas, especially around Bakel and in the Lower Goye, traditional rain-fed production is risky. Local farmers must irrigate, and if environmental conditions continue to follow the pattern of recent years, provision must be made to expand the Delegation's irrigation capacity. It is already late in this destructive process; a pragmatic and coordinated effort is needed to turn this adversity into an advantage.

Summary of Findings: Opportunities

1. Migrants underwrite the purchase of inputs and irrigation water costs. During meetings with farmers, the question was asked as to if they had taken steps to mobilize migrant capital to allow more people to engage in irrigation. Some "groupements" have made steps in this direction; others have not. There is a great potential for the development of multi-functional village-level organizations to handle credit, input supply, and marketing.

2. Farmers expressed a desire for technical assistance to develop local institutions. Such institutions would furnish credit, offer services for savings and investment, arrange input supply, and help with marketing. There is a clear need for expert assistance at this level. As one member of the T.A. Team has aptly noted: rehabilitation of the groupements is as important as rehabilitation of the perimeters themselves.

3. Available family labor does not appear to be a constraint to production and development. A process can be envisioned where family-based production achieves and then goes beyond subsistence into surplus. Once surpluses have been attained, there will be

ample scope for hired labor and the development of a more commercialized type of agriculture.

4. There is an obvious and critical need for extension services, especially for improved cereals seeds and for teaching productivity-raising techniques. Farmers appreciate what little has been done and are eager for more. Rice has proven to be a poor performer given its very substantial need for capital to finance production. Other cereal crops (sorghum, millet, maize) have shown returns to labor and capital from two to three-times that of rice. These crops can be produced using much less labor-intensive irrigation techniques.

5. Production during the dry season demonstrated substantial product values, especially in the case of onions and vegetables, in spite of yields well below optimum. Dry season production of improved varieties of local cereals as well as vegetable crops have a high potential for raising cropping intensities in the perimeters and bringing about dramatic changes in profitability. This potential can be achieved with the development of producer institutions and effective extension work.

6. The population has demonstrated the capacity to furnish significant amounts of intensive labor in the struggle against low capital resources and declining yields. This human resource can be mobilized in a coordinated program which makes infrastructural improvements in conjunction with producer institution development and agricultural extension

Recommendations for Monitoring

A number of recommendations subsequent to those made in the Interim Report are given below in the interests of improving the capacities of the monitoring system.

The project is currently in a state of transition. The recent evaluation has suggested the selection of perimeters which would be developed into "model" or "ideal-type" PIVs. These model perimeters would be replicated in a later phase. Whatever the final form of the next project phase, perimeters will be rehabilitated and work will be undertaken to develop the capacities of producer organizations (groupements).

Monitoring this year has shown a relatively clear and comprehensive picture of local reality as it is seen at the level of the household or concession economy. It is an essentially complete statement of irrigated agriculture as it is now which is contextualized in the overall economy of the Delegation. The principal constraints and a number of promising opportunities have been brought forward.
It is assumed that monitoring in the next 12 months will focus on

changes in the picture as it was portrayed in this last year. The 1989-90 agricultural year is in effect a baseline which will serve to assess the progress and impact of future interventions. If no such interventions are to be put into effect during 1990-91 agricultural year, the utility of continued monitoring would be minimal.

On the assumption that work will resume, a somewhat expanded program of monitoring is foreseen. "Monitoring" would take two forms and be divided into two teams, each with its own computer data base. The first team would undertake socio-economic monitoring along the same lines as was the case this year. This unit, the Socio-Economic Monitoring Unit, would serve to collect and analyze data needed to gauge impacts and inform decision-making by T.A. Team members.

A second team has a more active role: this group which could be called an, Implementation Tracking Unit, would work with T.A. Team members to collect data at the perimeter level and to verify conformity to crop schedules, irrigations, etc. and track the use of new interventions.

Recommendations concerning the Monitoring and Tracking Units are given below:

1. Sample Selection: next year's socio-economic monitoring program should operate in 10 concessions in 5 villages of which 4 villages are those selected for intensified work. Each concession should have members in the perimeter groupement. The fifth village need not have all concessions in a groupement. An effort should be made in sample selection to choose concessions representing a cross-section of households. This cross-section would span all social categories: blacksmiths, leatherworkers, and captifs as well as the upper echelons of local society. It should also assess relative wealth in terms of the number of migrants and other income sources which are not necessarily contingent on soci . class.

2. Monitoring Instruments: A new set of baseline demographic survey and monitoring instruments will be developed which will be better adapted to computer logging of data and subsequent analyses. Drawing on the experience of the past year, the new data collection forms will be clearer and more precise than those used to date. Specialized forms will be drawn up for measuring contre-saison crops so that more accurate data on recession and irrigated vegetable production may be made available.

3. Monitoring at the Groupement Level: This is the domain of the Tracking Unit. While it is indeed the case that the family or concession is the most solid social and economic institution in the Delegation, progress necessitates the development of groupement organizations which both transcend and serve family

interests. The Tracking Unit will be employed to keep abreast of events at the perimeter level. All perimeters should be monitored. This will entail, among many things, the accurate and timely measurements of all crop areas, accurate and extensive yield sampling, keeping an accurate track of the hours of motor-pump operation, inputs use, etc. This data will be essential for perimeter analysis which will also draw on concession-level data to determine labor days per crop, impacts, and other measures.

4. Staffing the Socio-Economic and Perimeter Tracking Units. Apart from the current data collection Supervisor, who should be retained in a supervisory position, a competition is recommended for hiring 5 data collectors for the socio-economic monitoring program, 4 monitors for the perimeter tracking activity, an one data entry clerk.

5. Institutionalization of the Monitoring Unit: Socio-economic monitoring is clearly defined as a function of the T.A. Team. It serves the interests of USAID by providing information needed to gauge project impacts; and it serves the interests of the Team and the project by informing decision-making in the development of the model perimeters.

On the operational side, it is anticipated that the SAED Chef de Suivi-Evaluation will work with the new Monitoring and Tracking Unit, probably as the manager of the Perimeter Tracking Unit. The mandate of SAED's Suivi-Evaluation at Bakel is one element of a larger SAED-wide monitoring program which is of a general nature. The role of the T.A. Team's Monitoring Unit is specific and critical to the 4 model perimeter program of work's success. It is anticipated that the Monitoring Unit will assist Suivi-Evaluation by sharing data, consulting on analytical procedures, and generally cooperating on a professional level. Given the importance of the Monitoring Unit's activities in the next phase, it would be unwise to formally allocate the Unit's field staff to collecting data for Suivi-Evaluation. The unit will also train and help with the professional development of data collectors. This will, in the longer term, be a significant contribution to SAED's monitoring and research capacity.

CON.	RIZ TR.	RICE DENT	'AID	TOUS PAYE	RECOLTE VAL.	HARVESTED T/CT/C.CFA	T.TR	T = tractor C=plough HA.	PJ/HA	T.CFA.	T.CFA/HA	PROD.T	T/HA	PJ/T	T.PAY CFA/J
405	279		582			N	861	0.6102	1411			1.694	2.78	508	***
101	142			31	9,435	T 20,000	173	1.2180	14229,435		24,167	3.696	3.03	47	
102	102			19	11,500	N	121	1.8126	6711,500		6,344	3.311	1.83	37	
103	398		23	31	7,500	N	452	1.3169	343 7,500		5,695	2.406	1.83	188	
104	176			40	30,000	N	216	2.9070	7430,000		10,320	7.700	2.65	28	
105	84		4	5	3,750	N	93	0.4095	227 3,750		9,158	1.617	3.95	58	
106	48		33			N	81	0.5714	142			0.693	1.21	117	
301	72		49			CT	121	0.3094	391			1.964	6.35	62	
302	156		47	17	12,750	N	220	0.7844	28012,750		16,254	2.734	3.49	80	
303	301		60	2	1,000	N	363	0.9124	398 1,000		1,096	3.465	3.80	105	
304	65		39		30,000	N	104	0.4876	21330,000		61,526	1.540	3.16	68	
305	225		38		3,750	N	263	1.1462	229 3,750		3,272	3.542	3.09	74	
306	312		12			N	324	0.4950	655			2.272	4.59	143	
401	618		13	10	8,400	N	641	0.8574	748 8,400		9,797	1.848	2.16	347	
402	803		49		12,750	N	852	1.1209	76012,750		11,375	1.309	1.17	651	
403	297			12	3,000	N	309	0.4741	652 3,000		6,328	1.463	3.09	211	
404	264		34	21	3,600	N	319	0.6204	514 3,600		5,803	1.771	2.85	180	
406	336		45	6	3,060	N	387	0.6495	596 3,060		4,711	1.348	2.08	287	
502	288					N	288	0.5036	572			1.078	2.14	267	
503	295			12		N	307	0.6684	459			2.772	4.15	111	
504	258			21		N	279	0.4079	684			1.155	2.83	242	
505	303		6			N	309	0.8860	349			2.002	2.26	154	
506	273		26	29	14,800	N	328	0.5626	58314,800		26,306	2.002	3.56	164	
TOT:	5816		478	256	155295	20000	6550	19.1212	9078*******			51.688			
OY:	264		32	18	10353		298	0.87	34311,686		9,168		2.70	127	60
%:	89		7	4			100%								

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ANNEX 2: REMITTANCES AND INPUT EXPENDITURES

Remitances: 6-1989 au 1-1990

CONC.	VALEUR en F.CFA.	no. ems.	Pop. res.	F.CFA./ resident	F.CFA. INTRANTS	F.CFA. CASH	F.CFA. CEREALES	F.CFA. HUILE	F.CFA. AUTRE
101	149,258	2	24	6,219	59,422	52,000	22,758	74,500	
102	0	0	13		9,400				
103	600,000	6	35	17,143	23,500	600,000			
104	565,000	2	39	14,487	132,000	405,000		160,000	
105	344,500	2	16	21,531	29,750	200,000	72,500	72,000	
106	76,500	0	16	4,781	19,940	62,000	14,500		
TTOT:	1,735,258			64,162	274,012	1,319,000	109,758	306,500	0
MMOY:	347,052			12,832	45,669	263,800	36,586	102,167	ERR
201	210,000	8	23	9,130	14,800		210,000		
202	750,000	7	28	26,786	9,400	555,000	115,000	80,000	
203	833,500	10	13	64,115	2,500	760,000	73,500		
204	955,000	3	16	59,688	15,900	700,000	175,000	80,000	
205	556,700	3	22	25,305	5,600	326,700	150,000	80,000	
206	448,000	2	19	23,579	4,700	240,000	60,000	148,000	
TTOT:	3,753,200			208,603	52,900	2,581,700	783,500	388,000	0
MMOY:	625,533			34,767	8,817	516,340	130,583	97,000	0

CONC.	VALEUR en F.CFA.	no. ems.	pop. resi	F.CFA./ resident	F.CFA. INTRANTS	F.CFA. CASH	F.CFA. CEREALES	F.CFA. HUILE	F.CFA. AUTRE
301	61,800	* 1	14	4,414	21,685	45,000	16,800		
302	92,700	1	11	8,427	13,700	55,000	29,000		8,700
303	468,350	4	35	13,381	52,320	425,000	43,350		
304	0	0	9	0	16,475				
305	224,000	1	16	14,000	24,900	210,000	14,000		
306	0	0	7	0	36,660				
TTOT:	846,850			40,223	165,740	735,000	103,150	0	8,700
MMOY:	211,713			10,056	41,435	183,750	25,788	0	2,175
401	615,500	2	31	19,855	102,694	15,000	600,500		
402	160,000	1	19	8,421	51,000	25,000	135,000		
403	29,000	* 1	7	4,143	9,820	5,000	24,000		
404	56,500	* 1	9	6,278	45,710		56,500		
405	355,000	2	28	12,679	51,380	50,000	180,000		125,000
406	168,700	3	20	8,435	30,870	30,000	118,700		20,000
TTOT:	1,384,700			59,810	291,474	125,000	1,114,700	0	145,000
MMOY:	230,783			9,968	48,579	20,833	185,783	0	24,167

CONC.	VALEUR en F.CFA.	no. ems.	pop. resi	F.CFA./ resedent	F.CFA. INTRANTS	F.CFA. CASH	F.CFA. CEREALES	F.CFA. HUILE	F.CFA. AUTRE
501	0	--------							
502	132,800	1	31	4,284	44,713		132,800		
503	376,000	7	25	15,040	55,695	200,000	176,000		
504	64,000	0	11	5,818	37,300	24,000	40,000		
505	185,000	7	22	8,409	27,380	60,000	125,000		
506	136,500	6	12	11,375	36,824	50,000	86,500		
TTOT:	894,300			44,926	201,912	334,000	560,300	0	0
MMOY:	178,860			8,985	40,382	66,800	112,060	0	0
TOUS SONINKE									
Ta:	8,614,308			417,723	986,038	5,094,700	2,671,408	694,500	153,700
Tm:	331,320			16,066	37,925	195,950	102,746	26,712	5,912
ALL SONINKE		80	571						

601	57,500	1	8	7,188		20,000	37,500		
602	0	0	10	0					
603	424,200	3	19	22,326		159,000	139,700	125,500	
604	42,750	* 1	6	7,125		30,000	12,750		
605	0	--------							
606	155,600	1	25	6,224	3,000	20,400	81,000	54,200	
TTOT:	680,050			42,863	3,000	229,400	270,950	179,700	0
MMOY:	170,013			10,716		57,350	67,738	59,900	0

CONC.	VALEUR en F.CFA.	no.Pop. ems.res.		F.CFA./ resident	F.CFA. INTRANTS	F.CFA. CASH	F.CFA. CEREALES	F.CFA. HUILE	F.CFA. AUTRE
701	0	1	8	0					
702	0	0	4	0					
703	8,000	1	11	727			8,000		
704	7,250	1	5	1,450	5,000		7,250		
705	0	0	4	0					
706	83,000	1	20	4,150	5,000	15,000	68,000		
TTOT:	98,250			6,327	10,000	15,000	83,250	0	0
MMOY:	49,125	9	120	3,164	5,000		41,625	0	0
Ta:	778,300			49,190	13,000	244,400	354,200	179,700	0
Ma:	111,186			7,027	1,857	34,914	50,600	25,671	0

ANNEX 2: REMITTANCES AND INPUT EXPENDITURES

WATER COST MODULE FOR PERIMETER: VILLAGE

25-Mar-90
FILE: VILLAGE / (Water)

ITEM				Rainy Season	Dry Season
Motor: make, model, size		1 Lister HR-2			
Pump: make, model, size		G-R			
Rated pump output, M3 / hr	B	319			
Operating head in Rainy/Dry season, M	B			7	16
Pump output in Rainy/Dry season, M3/hr	B			319	230
Pump Efficiency (default .75)	H	0.75		0.75	0.75
Brake HP Hrs per liter of fuel		4.45	default	4.45	4.45
GMP Investment cost, F CFA	H	8,459,840			
Pipe Investment cost	S	2,000,000			
Civil Engr works for water	S	2,355,000			
TOTAL investment cost, F CFA		10,459,840			
Hrs of service (pipes 2x this)	S,*	6,000			
Amortization of GMP per hr		1,410			
Amortization of repair costs / hr		649			
Amort. of pipes and canals / hr		363			
Total Amortization per hour		2,421			
FIXED COSTS or Amortization / M3 of water pumped, Rainy/dry season				7.59	10.53
Fuel used per hour, liters	H			2.47	4.08
Fuel cost per liter, 1990 price		210			
GMP fuel cost per hour				519.32	855.85
GMP oil + lube, % of fuel cost	S,H		17	88.29	145.49
GMP routine maintenance, % of fuel	H		6	31.16	51.35
Pompiste salary expressed as % of fuel cost			6	31.16	51.35
VARIABLE (Operating) COSTS PER HOUR OF PUMPING				669.93	1104.05
VARIABLE COSTS / M3 WATER PUMPED, Rainy/Dry season				2.10	4.80
TOTAL (Fixed + Var.) COST OF WATER PER M3 PUMPED Rainy/dry season				9.69	15.33
Assumed water conveyance efficiency, percent	H			75	75
Water delivered to field, M3/hour, Rainy/dry season				239	173
VAR. COSTS PER M3 DEL'D TO FIELD, Rainy/Dry season				2.80	6.40
FIXED COSTS PER M3 DEL'D TO FIELD, Rainy/Dry season				10.12	14.04
TOTAL (Fixed + Var.) COST OF WATER PER M3 DELIVERED: Rainy/dry season				10.39	16.93
Water pumped, M3 / l of fuel				129	56
Water del. to field, M3 per l of fuel				97	42

Sources of data:
S =SAED data, H = Harza engineers, K = Keita
B = BSIP EOP report, * = guesses

CROPS MODULE FOR PERIMETER: VILLAGE 25-Mar-90
Rainy Season (VILLAGE RR-Ave
RICE VILLAGEOISE IN AN AVERAGE PERIMETER
(Source of data)
Socio-Economic Survey, averages

INPUTS		Amount	Price	Cost,cfa	% Distr
Seed, kg/ha		?	?	Only	
Fert: Urea, kg/ha		?	?	totals	
Fert: NPK (18-46-0) kg/ha		?	?	are	
Pesticides		?	?	known.	
		HOURS	MANDAYS		
Labor: Land prep, man hrs/ha		Labor breakdown not known			ERR
Labor: Plant (direct seeding)			?		ERR
Labor: Transplant			?		ERR
Labor: Weed			?		ERR
Labor: Irrigate			?		ERR
Labor: Harvest and Thresh			?		ERR
Labor: Storage and Transport			?		ERR
Labor: TOTAL in MD / ha	SE		343.0		ERR
Family Labor Unpaid * %	96		329.3		
Hired labor: % & ave rate	4	607	13.7	8,328	
		AMT.	PRICE		
Water requirement, m3/ha	H	7,800	2.80	21,841	
Tools, annual cost per ha	K			4,755	
Mech/Animal Traction, hrs/ha		0	0	0	

SUMMARY OF COSTS:			
(per ha basis)	Labor, Hired	8,328	10.6
	Water costs)	21,841	27.7
	Seed, fert., pesticides	44,000	55.7
	Mech/Animal Traction	0	0.0
	Tools	4,755	6.0
	Subtotal	78,924	100.0
	Credit = 0 % of cash costs	0	0.0
GRAND TOTAL OF COSTS (Purchased Inputs)		78,924	100.0

PRODUCTS	Yield	Price	Value	For .87 ha
Paddy/Raw Grain. hg/ha	2700	82	221,400	192,618
Straw. kg/ha **	?	?	0	
TOTAL PRODUCTS			221,400	192,618
Net Income per ha (Value of crop less costs), F CFA			142,476	123,954

Net Income per MD of family labor, cfa	433
Net Income per m3 of water, cfa	18
Paddy per manday of family labor, kg	8
Paddy per m3 of water, kg	0.35
Fuel used per hectare of crop, liters	81
Cost of Production per kg of paddy, cfa:-	
-- assuming all labor is unpaid	26
-- if all labor is charged à 607 per MD	103

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CROPS MODULE FOR PERIMETER: VILLAGE 25-Mar-90
Rainy Season FILE: VILLAGE RR-Ballou
RICE VILLAGEOISE IN THE PERIMETER OF BALLOU
(Source of data)
Socio-Economic Survey of Ballou

INPUTS		Amount	Price	Cost,cfa	% Distr
Seed, kg/ha		?	?	Only	
Fert: Urea, kg/ha		?	?	totals	
Fert: NPK (18-46-0) kg/ha		?	?	are	
Pesticides		?	?	known.	
		HOURS	MANDAYS		
Labor: Land prep, man hrs/ha		Labor breakdown not known			ERR
Labor: Plant (direct seeding)			?		ERR
Labor: Transplant			?		ERR
Labor: Weed			?		ERR
Labor: Irrigate			?		ERR
Labor: Harvest and Thresh			?		ERR
Labor: Storage and Transport			?		ERR
Labor: TOTAL in MD / ha	SE		531.0		ERR
Family Labor Unpaid %	96		509.8		
Hired labor: % & ave rate	4	239	21.2	5,076	
		AMT.	PRICE		
Water requirement, m3/ha	H	7,800	2.80	21841	
Tools, annual cost per ha	K			4,755	
Mech/Animal Traction, hrs/ha		0	0	0	

SUMMARY OF COSTS: (per ha basis)			
Labor, Hired		5,076	5.8
Water costs)		21,841	24.9
Seed, fert., pesticides		40,382	45.9
Mech/Animal Traction		0	0.0
Tools		4,755	5.4
	Subtotal	72,054	82.0
Credit =	0 % of cash costs	0	0.0
GRAND TOTAL OF COSTS (Purchased Inputs)		72,054	82.0

PRODUCTS	Yield	Price	Value	For .61 ha
Paddy/Raw Grain. hg/ha	2970	82	243,540	148,559
Straw. kg/ha	?	?	0	
TOTAL PRODUCTS			243,540	148,559
Net Income per ha (Value of crop less costs), F CFA			171,486	104,606
Net Income per MD of family labor, cfa			336	
Net Income per m3 of water, cfa			22	
Paddy per manday of family labor, kg			6	
Paddy per m3 of water, kg			0.38	
Fuel used per hectare of crop, liters			81	
Cost of Production per kg of paddy, cfa:-				
-- assuming all labor is unpaid			23	
-- if all labor is charged à	239 per MD		65	

CROPS MODULE FOR PERIMETER: VILLAGE 25-Mar-90
Rainy Season FILE: VILLAGE RR-Aroun
RICE VILLAGEOISE IN THE PERIMETER OF AROUNDOU
(Source of data)
Socio-Economic Survey of Aroundou

INPUTS		Amount	Price	Cost,cfa	% Distr
Seed, kg/ha		?	?	Only	
Fert: Urea, kg/ha		?	?	totals	
Fert: NPK (18-46-0) kg/ha		?	?	are	
Pesticides		?	?	known.	
		HOURS	MANDAYS		
Labor: Land prep, man hrs/ha		Labor breakdown not known			ERR
Labor: Plant (direct seeding)			?		ERR
Labor: Transplant			?		ERR
Labor: Weed			?		ERR
Labor: Irrigate			?		ERR
Labor: Harvest and Thresh			?		ERR
Labor: Storage and Transport			?		ERR
Labor: TOTAL in MD / ha	SE		674.0		ERR
Family Labor Unpaid %	98		660.5		
Hired labor: % & ave rate	2	629	13.5	8,479	
		AMT.	PRICE		
Water requirement, m3/ha	H	7,800	2.80	21,841	
Tools, annual cost per ha	K			4,755	
Mech/Animal Traction, hrs/ha		0	0	0	

SUMMARY OF COSTS:			
(per ha basis)	Labor, Hired	8,479	9.6
	Water costs)	21,841	24.9
	Seed, fert., pesticides	48,597	55.3
	Mech/Animal Traction	0	0.0
	Tools	4,755	5.4
	Subtotal	83,672	95.2
	Credit = 0 % of cash costs	0	0.0
GRAND TOTAL OF COSTS (Purchased Inputs)		83,672	95.2

PRODUCTS	Yield	Price	Value	For .62 ha
Paddy/Raw Grain. hg/ha	2180	82	178,760	110,831
Straw. kg/ha	?	?	0	
TOTAL PRODUCTS			178,760	110,831

Net Income per ha (Value of crop less costs), F CFA	95,088	58,955
Net Income per MD of family labor, cfa	144	
Net Income per m3 of water, cfa	12	
Paddy per manday of family labor, kg	3	
Paddy per m3 of water, kg	0.28	
Fuel used per hectare of crop, liters	81	
Cost of Production per kg of paddy, cfa:-		
-- assuming all labor is unpaid	34	
-- if all labor is charged à 629 per MD	229	

CROPS MODULE FOR PERIMETER: VILLAGE 25-Mar-90
Rainy Season FILE: VILLAGE RR-Bakel
RICE VILLAGEOISE IN THE PERIMETER OF BAKEL
(Source of data)
Socio-Economic Survey of Bakel

INPUTS		Amount	Price	Cost,cfa	% Distr
Seed, kg/ha		?	?	Only	
Fert: Urea, kg/ha		?	?	totals	
Fert: NPK (18-46-0) kg/ha		?	?	are	
Pesticides		?	?	known.	
		HOURS	MANDAYS		
Labor: Land prep, man hrs/ha		Labor breakdown not known			ERR
Labor: Plant (direct seeding)			?		ERR
Labor: Transplant			?		ERR
Labor: Weed			?		ERR
Labor: Irrigate			?		ERR
Labor: Harvest and Thresh			?		ERR
Labor: Storage and Transport			?		ERR
Labor: TOTAL in MD / ha	SE		337.0		ERR
Family Labor Unpaid %	99		333.6		
Hired labor: % & ave rate	1	1500	3.4	5,055	
		AMT.	PRICE		
Water requirement, m3/ha	H	7,800	2.80	21,841	
Tools, annual cost per ha	K			4,755	
Mech/Animal Traction, hrs/ha		0	0	0	

SUMMARY OF COSTS: (per ha basis)			
Labor, Hired		5,055	5.8
Water costs)		21,841	24.9
Seed, fert., pesticides		41,435	47.1
Mech/Animal Traction		0	0.0
Tools		4,755	5.4
Subtotal		73,086	83.2
Credit =	0 % of cash costs	0	0.0
GRAND TOTAL OF COSTS (Purchased Inputs)		73,086	83.2

PRODUCTS	Yield	Price	Value	For .69 ha
Paddy/Raw Grain. hg/ha	3750	82	307,500	212,175
Straw. kg/ha	?	?	0	
TOTAL PRODUCTS			307,500	212,175
Net Income per ha (Value of crop less costs), F CFA			234,414	161,746

Net Income per MD of family labor, cfa	703
Net Income per m3 of water, cfa	30
Net Income as yield on cash spent on inputs, %	320.7
Paddy per manday of family labor, kg	11
Paddy per m3 of water, kg	0.48
Fuel used per hectare of crop, liters	81
Cost of Production per kg of paddy, cfa:-	
-- assuming all labor is unpaid	18
-- if all labor is charged at 1500 per MD	153

CROPS MODULE FOR PERIMETER: VILLAGE 25-Mar-90
Rainy Season FILE: VILLAGE RR-Diawa
RICE VILLAGEDISE IN THE PERIMETER OF DIAWARA
(Source of data)
Socio-Economic Survey of Diawara

INPUTS		Amount	Price	Cost,cfa	% Distr
Seed, kg/ha		?	?	Only	
Fert: Urea, kg/ha		?	?	totals	
Fert: NPK (18-46-0) kg/ha		?	?	are	
Pesticides		?	?	known.	
		HOURS	MANDAYS		
Labor: Land prep, man hrs/ha		Labor breakdown not known			ERR
Labor: Plant (direct seeding)			?		ERR
Labor: Transplant			?		ERR
Labor: Weed			?		ERR
Labor: Irrigate			?		ERR
Labor: Harvest and Thresh			?		ERR
Labor: Storage and Transport			?		ERR
Labor: TOTAL in MD / ha	SE		138.0		ERR
Family Labor Unpaid %	89		122.8		
Hired labor: % & ave rate	11	494	15.2	7,499	
		AMT.	PRICE		
Water requirement, m3/ha	H	7,800	2.80	21841	
Tools, annual cost per ha	K			4,755	
Mech/Animal Traction, hrs/ha		0	0	0	

SUMMARY OF COSTS: (per ha basis)			
Labor, Hired		7,499	8.5
Water costs)		21,841	24.9
Seed, fert., pesticides		45,669	52.0
Mech/Animal Traction		0	0.0
Tools		4,755	5.4
	Subtotal	79,764	90.8
Credit =	0 % of cash costs	0	0.0
GRAND TOTAL OF COSTS (Purchased Inputs)		79,764	90.8

PRODUCTS	Yield	Price	Value	For 1.36ha
Paddy/Raw Grain. kg/ha	2360	82	193,520	263,187
Straw. kg/ha	?	?	0	
TOTAL PRODUCTS			193,520	263,187
Net Income per ha (Value of crop less costs), F CFA			113,756	154,708
Net Income per MD of family labor, cfa			926	
Net Income per m3 of water, cfa			15	
Paddy per manday of family labor, kg			19	
Paddy per m3 of water, kg			0.30	
Fuel used per hectare of crop, liters			81	
Cost of Production per kg of paddy, cfa:-				
-- assuming all labor is unpaid			31	
-- if all labor is charged à	494 per MD		60	

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MAIS PLUVIALRAIN-MAIZE

CON.	TR.	DENT'AID	TR.PA	VAL.	T/CT/C.	CFA	T.TR	HA.	PJ/HA	T.CFA.	T.CFA/HA	PROD.T	T/HA	PJ/T	L.PAYE CFA/J
106	9				N		9	0.1256	72			0.024	0.19	375	
202	68	6			N		74	0.4158	178			0.132	0.32	561	
203	60				N		60	0.2911	206			0.182	0.63	330	
206	11		2	1,000	N		13	0.1406	92	1,000	7,112	0.036	0.26	361	
402	159				N		159	0.1995	797			0.036	0.18	4417	
405	14	350			N		364	0.5032	723			0.693	1.38	525	
502	125				N		125	0.8400	149			0.945	1.13	132	
503	265	30			N		295	0.9553	309			1.440	1.51	205	
504	77				N		77	0.1020	755			0.225	2.21	342	
505	115				N		115	0.1697	678			0.225	1.33	511	
506	53		5	1,500	N		58	0.1020	569	1,500	14,706	0.885	8.68	66	
601	72	1	1	2,250	N		74	3.5317	21	2,250	637	0.500	0.14	148	
602	38		2	1,000	C	6,000	40	1.3739	29	7,000	5,095	0.500	0.36	80	
603	25	8	9	2,700	C		42	1.6827	25	2,700	1,605	1.600	0.95	26	
604	18	1			C		19	0.1980	96			0.800	4.04	24	
606	24		2	1,000	N		26	0.8365	31	1,000	1,195	0.500	0.60	52	
701	60				N		60	0.7742	77			0.650	0.84	92	
702	46				N		46	0.6501	71			1.550	2.38	30	
703	57				N		57	0.1353	421			0.500	3.70	114	
704	48	6	4	400	N		58	0.8044	72	400	497	2.000	2.49	29	
705	95	4	10	11,000	N		109	0.2973	367	11,000	37,000	0.450	1.51	242	
706	219	2			N		221	0.3383	653			0.600	1.77	368	
TOT:	1658	408	35	20,850		6,000	2101	14.4672	639	126,850		14.473			
OY:	75	45	4	2,606			96	0.66	145	3,356	1,856		1.00	145	596
% :	79	19	2												

CO. P.MIL NON-IRMILLE

CON.	TR.	DENT'AID	TR.PA	VAL.	T/CT/C.	CFA	T.TR	HA.	PJ/HA	T.CFA.	T.CFA/HA	PROD.T	T/HA	PJ/T	L.PAY CFA/J
602	20		4	2,000	N	0	24	0.6822	35	2,000	2,932	0.250	0.37	96	
701	46				N	0	46	0.5127	90			0.800	1.56	57	
703	54				N	0	54	0.9571	56	300	313	0.500	0.52	108	
706	103	10			N	0	113	0.4936	229			0.650	1.32	174	
TOT:	223	10	4	2,000			237	2.6456	410	2,300	3,245	2.200			
OY:	56						59	0.44	90	1,150	1,623		0.83	108	500

SORGHO IRR. SORGHUM

CON.	TR.	DENT'AID	TR.PA	VAL.	T/CT/C.CFA	T.TR	HA.		T.CFA.	T.CFA/HA	PROD.T	T/HA	PJ/T	T.PAY CFA.J
101	86		18	9,000	N	104	1.1644	89	9,000	7,729	0.700	0.60	149	
102	80	4	8	5,000	N	92	0.8590	107	5,000	5,821	0.600	0.70	153	
103	275	10		3,000	N	285	2.6182	109	3,000	1,146	0.988	0.38	288	
105	61		15	11,250	N	76	0.8280	92	11,250	13,587	0.600	0.72	127	
TOT:	502	14	41	28250		557	5.4696	397	28,250		2.888			
OY:	126	7	14	7063		139	1.37	102	7,063	5,165		0.53	193	689
% :	90	3	7											

SORGHO PLUVI SORGHUM RAIN-FED

CON.	TR.	DENT'AID	TR.PA	VAL.	T/CT/C.CFA	T.TR	HA.	PJ/HA	T.CFA.	T.CFA/HA	PROD.T	T/HA	PJ/T	T.PAY CFA/J
104	93	14			N	107	3.1149	34		0	2.000	0.64	54	
105	77	8	5	4,000	N	90	3.4380	26	4,000	1,163	0.228	0.07	395	
106	46	9			N	55	0.0498	1104		0	0.200	4.02	275	
301	41	1			N	42	0.4462	94		0	0.150	0.34	280	
302	46	19	5	3,500	N	70	0.6274	112	3,500	0	0.350	0.56	200	
303	292				N	292	2.4233	120		0	0.400	0.17	730	
305	119				N	119	1.9822	60		0	0.225	0.11	529	
401	106		12	4,400	N	118	0.8049	147	4,400	5,467	0.900	1.12	131	
403	94				N	94	0.1015	926		0	0.100	0.99	940	
405	14	350			N	364	0.6726	541		0	2.500	3.72	146	
406	244	1		3,060	N	245	2.5000	98	3,060	1,224	0.500	0.20	490	
502	267				N	267	7.1299	37		0	2.200	0.31	121	
503	264	1			N	265	6.5239	41		0	3.658	0.56	72	
504	75				N	75	0.4695	160		0	1.467	3.12	51	
505	253	2	1	350	N	256	3.6250	71	350	97	3.800	1.05	67	
OT:	2031	405	23	15310		2459	33.9091	3572	15310	7,951	18.678			666
OY:	135	45	6	3062		163.9	2.26	238	3062	530		0.55	432	
% :	83	16	1			100%								

MAIS IRRIGUEMAIZEIRRIGATED

CON.	TR.	DENT'AID	TR.PA	VAL.	T/CT/C.CFA		T.TR	HA.	PJ/HA	T.CFA.	T.CFA/HA	PROD.T	T/HA	PJ/T	T.PAY CFA/J
104	102	0	20	1,500	N	0	122	0.2214	551	1,500	6,775	0.156	0.70	782	
106	34	0	0	0	N	0	34	0.0287	1185	0	0	0.048	1.67	708	
401	33	0	2	2,000	N	0	35	0.0835	419	2,000	23,952	0.315	3.77	111	
TOT:	169	0	22	3,500			191	0.3336	2155	3,500		0.519			
MOY:	56	0	7	1,167			64	0.11	573	1,750	10,492		1.56	368	159
%:	88	0	12												

CON.	ARACHIDE TR.	DENT'AID	GROUNDNUT TR.PA	VAL.	T/CT/C.CFA	T.TR	HA.	PJ/HA	T.CFA.	T.CFA/HA	PROD.T	T/HA	PJ/T	T.PAY CFA/J
303	363	8	8	8,000	N	379	1.3550	280	8,000	5,904	0.711	0.52	533	
305	179	12	2	1,500	N	193	1.0260	188	1,500	1,462	0.840	0.82	230	
401	581	12	2	2,000	N	595	0.6943	857	2,000	2,881	0.990	1.43	601	
402	180	33	10	10,000	N	223	1.3768	162	10,000	7,263	0.840	0.61	265	
403	55	4			N	59	1.5945	37			0.350	0.22	169	
404	124				N	124	0.8081	153			0.930	1.15	133	
405	151	62			N	213	0.4557	467			1.120	2.46	190	
406	144	1			N	145	1.5360	94			1.120	0.73	129	
502	597	2	3	3,000	N	602	2.7818	216	3,000	1,078	2.461	0.88	245	
503	1037				N	1037	6.4367	161			6.600	1.03	157	
504	347				N	347	0.6998	496			1.470	2.10	236	
505	515	10	9	4,850	N	534	2.6552	201	4,850	1,827	3.780	1.42	141	
506	220	5	7	5,750	CX	10,000	232	0.5483	423	15,750	28,725	0.930	1.70	249
601	143	2	6	6,000	C		151	1.1652	130	6,000	5,149	0.847	0.73	178
602	100		13	17,000	C	311,500	113	1.2700	89	28,500	22,441	0.889	0.70	127
603	42				C		42	0.4150	101			0.290	0.70	145
604	49	1			N		50	1.0190	49			0.713	0.70	70
606	392	8	5	3,500	N		405	2.5500	159	3,500	1,373	1.785	0.70	227
701	52				N		52	0.2385	218			0.140	0.59	371
703	51				C		51	0.0835	611			0.245	2.93	208
704	34				N		34	0.2194	155			0.350	1.60	97
705	178				N		178	0.3467	513			0.389	1.12	458
706	172		1	2,000	N		173	1.9066	91	2,000	1,049	0.945	0.50	183
TOT:	5706	160	66	63,600		21,500	5932	31.1820	585	285,100		28.735		
OY:	248	12	6	5,782		10,750	258	1.36	190	6,546	7,196		0.92	206	964
% :	96	3	1				100%							

CONC.AG. SUMMARY DIAWARA SOMMAIRE

NO.	T. AREA	AREA RICE	%RICE	AREA IRR.	%IRRIG.
101	7.2454	1.2180	17%	2.3844	33%
102	5.9720	1.8126	30%	2.6716	45%
103	4.3908	1.3169	30%	3.9351	90%
104	12.1900	2.9070	24%	3.1284	26%
105	7.9498	0.4095	5%	1.2375	16%
106	1.5595	0.5714	37%	0.6001	38%
TOT.	39.3075	8.2354	21%	13.9571	36%

YELINGARA

CONC.AG. SUMMARY YELINGARASOMMAIRE

NO.	T. AREA	SOR.IRR.	%SOR.IRR.	AREA IRR.	%IRRIG.
201	1.9604	0.5111	26%	0.5111	26%
202	2.0056	0.9989	50%	0.9989	50%
203	1.9759	0.5393	27%	0.5393	27%
204	0.9988	0.4318	43%	0.8302	83%
205	4.4031	1.3584	31%	1.3584	31%
206	8.6920	0.9440	11%	0.9440	11%
TOT.	20.0358	4.7835	24%	5.1819	26%

CONC.AG. SUMMARY BAKEL SOMMAIRE

NO.	T. AREA	AREA RICE	%RICE	AREA IRR.	%IRRIG.
301	1.9567	0.3094	16%	N/A	N/A
302	1.4118	0.7844	56%		
303	4.6907	0.9124	19%		
304	0.7594	0.4876	64%		
305	4.1544	1.1462	28%		
306	0.8697	0.4950	57%		
TTOT:	13.8427	4.1350	30%		

AROUNDOU

CONC.AG. SUMMARY AROUNDOU SOMMAIRE

NO.	T. AREA	AREA RICE	%RICE	AREA IRR.	%IRRIG.
401	2.1381	0.8574	40%	0.9409	44%
402	2.7683	1.1209	40%	1.1209	40%
403	0.5915	0.4741	80%	0.4741	80%
404	0.7568	0.6204	82%	0.6204	82%
405	2.2416	0.6102	27%	0.6102	27%
406	3.2530	0.6495	20%	0.6495	20%
TTOT:	11.7493	4.3325	37%	4.4160	38%

CONC.AG. SUMMARY BALLOU SOMMAIRE

NO.	T. AREA	AREA RICE	%RICE	AREA IRR.	%IRRIG.
501	0.0000				
502	11.2553	0.5036	4%	n/a	n/a
503	14.5843	0.6684	5%		
504	1.6792	0.4079	24%		
505	7.3159	0.8660	12%		
506	1.2128	0.5626	46%		
TTOT:	36.0475	3.0085	8%		

CONC. NO.	AG. SUMMARY T. AREA	AREA RICE	NAYE %RICE	SOMMAIRE AREA IRR.	%IRRIG.
601	4.6969	0.0000	0%	N/A	N/A
602	4.1371	0.0000	0%		
603	2.1007	0.0000	0%		
604	0.7654	0.0000	0%		
605	0.0000	0.0000	0%		
606	6.6860	0.0000	0%		
TTOT:	18.3861	0.0000	0%		

CONC. NO.	AG. SUMMARY T. AREA	AREA RICE	GUITTA %RICE	SOMMAIRE AREA IRR.	%IRRIG.
701	1.5704	N/A	N/A	N/A	N/A
702	0.6501				
703	1.1759				
704	1.0238				
705	0.6440				
706	2.7385				
TTOT:	7.8027				

LABOR				PRODUCTION CEREALES			%	kg./	no.	Con.
	TOTAL LAB	%RICE	%IRRIG.	TONNES	%RICE	%IRRIG.	subsist.	capita	consumers	No.
	533	32%	52%	4.396	84%	100%	90%	129	24	101
	310	39%	69%	3.911	85%	100%	148%	212	13	102
	842	54%	88%	3.394	71%	100%	51%	73	35	103
	522	41%	65%	9.856	78%	80%	128%	184	39	104
	272	34%	62%	2.445	66%	91%	82%	117	16	105
	188	43%	61%	1.345	52%	55%	48%	69	16	106
2	2667	43%	69%	25.347	77%	89%	91%	130	143	ALL

LABOR:		%IRR.		PRODUCTION CEREALES						Con.
	TOTAL LAB	SORG	%IRRIG.	TONNES	%I.SOR.	%IRRIG.				No.
	253	39%	39%	1.200	58%	58%	36%	52	23	201
	249	40%	40%	0.732	82%	82%	18%	26	28	202
	263	27%	27%	0.582	69%	69%	31%	45	13	203
	221	41%	81%	2.388	50%	100%	104%	149	16	204
	258	25%	25%	1.000	70%	70%	32%	45	22	205
	495	19%	19%	1.291	46%	46%	48%	68	19	206
1	1739	30%	35%	7.193	58%	75%	42%	59	121	ALL

LABOR				PRODUCTION CEREALES						CON.
	TOTAL LAB	%RICE	%IRRIG.	TONNES	%RICE	%IRRIG.				NO.
	177	68%	N/A	2.114	93%	N/A	71%	102	14	301
	290	76%		3.083	89%		135%	193	11	302
1	1034	35%		3.865	90%		53%	76	35	303
	129	81%		1.540	100%		78%	111	9	304
	575	46%		3.767	94%		110%	158	16	305
	342	95%		2.272	100%		148%	211	7	306
2	2547	55%		16.640	93%		85%	122	92	ALL

LABOR				PRODUCTION CEREALES						CON.
	TOTAL LAB	%RICE	%IRRIG.	TONNES	%RICE	%IRRIG.				NO.
1	1389	46%	49%	3.063	60%	71%	55%	78	31	401
1	1317	65%	65%	1.559	84%	84%	41%	58	19	402
	462	67%	67%	1.563	94%	94%	105%	150	7	403
	443	72%	72%	1.771	100%	100%	89%	128	9	404
1	1857	46%	46%	4.824	35%	35%	106%	151	28	405
	777	50%	50%	1.847	73%	73%	48%	69	20	406
6	6245	54%	55%	14.628	64%	67%	69%	99	114	ALL

LABOR				PRODUCTION CEREALES						CON.
	TOTAL LAB	%RICE	%IRRIG.	TONNES	%RICE	%IRRIG.				NO.
										501
1	1282	22%	N/A	4.223	26%	N/A	142%	202	19	502
1	1885	16%		7.870	35%		193%	276	25	503
	806	35%		2.847	41%		155%	222	11	504
1	1184	26%		6.027	33%		169%	242	22	505
	599	55%		2.857	70%		126%	180	12	506
4	4613	33%		23.824	38%		162%	232	89	ALL

LABOR TOTAL LAB	%RICE	%IRRIG.	PRODUCTION TONNES	ARACHIDES TONNES	% subsist.	kg./ capita	no. consumers	Con. No.
225	N/A	N/A	0.500	0.8470	44%	63	8	601
153			1.182	0.8890	83%	118	10	602
84			1.600	0.2905	59%	84	19	603
69			0.800	0.7133	22%	31	26	604
0			0.000	0.0000				605
431			0.500	1.7850	14%	20	25	606
962			4.582	4.5248	36%	52	88	ALL

LABOR TOTAL LAB	%RICE	%IRRIG.	CEREALES PRODUCTION TONNES	ARACHIDE TONNES				CON. NO.
158	N/A	N/A	1.450	0.1400	127%	181	8	701
46			1.550	0.0000	271%	388	4	702
162			1.000	0.2450	64%	91	11	703
92			2.000	0.3500	280%	400	5	704
287			0.450	0.3885	79%	113	4	705
507			1.250	0.9450	44%	63	20	706
1 1252			7.700	2.0685	104%	148	52	ALL

ANNEX VI: PAGE 1 of 1

RAINFALL

Bakel Delegation: 1989

Month	Faleme Kidira	in mm. Bakel	L.Goye Diawara
6	110.3	88.6	97.0
7	172.8	81.7	80.5
8	330.4	164.4	109.0
9	124.5	5.0	30.7
10	24.8	39.0	11.0
Total	762.8	378.7	328.2

ANNEX "A" PAGE 1

FALO AND CONTRE-SAISON IRRIGATION

AREAS CULTIVATED & PERSON-DAYS OF LABOR

FALO CONTRE SAISON FSCI2.WK1

CON.	SUPERF.	P-J(t)	P-J	faP-J	puP.CFA.
202	2.6990	103	103	0	0
203	1.1275	140	140	0	0
204	0.3759	101	101	0	0
206	0.5243	96	96	0	0
301	0.4986	58	58	0	0
302	0.1883	31	31	0	0
303	0.3313	92	85	7	4,350
401	0.0838	92	92	0	0
402	0.3229	134	134	0	0
404	0.1135	52	52	0	0
504	0.1544	59	59	0	0
505	0.2722	72	72	0	0
506	0.5002	38	38	0	0
601	0.3104	134	131	3	1,200
603	2.1236	109	109	0	
701	1.0770	72	72	0	
702	0.2646	40	40	0	
703	0.2244	41	41	0	
704	0.4521	83	82	1	1,500
	11.6440	1547	1536	11	7050

P-J/HA.= 132.86

CONTRE-SAISONN IRRIGGUE

CON

101	0.3458	71	58	1	320,000
104	0.3926	50	49	1	750
105	0.0288	47	45	2	1,500
401	0.9920	47	47	0	0
402	0.1216	44	44	0	0
403	0.1346	17	17	0	0
405	0.0625	59	59	0	0
406	0.0786	46	46	0	0
504	0.1408	154	154	0	0
505	0.1408	110	110	0	0
506	0.1162	44	44	0	0
TOT	2.5543				
MOY	0.2322				

CON.	SUPERF.	P-J(t)	P-J	faP-J	paP.CPA.	C-1 MAIS	C-2 SORGHO	C-3 ONION	C-4 PATATE	C-5 AUTRE	C-1 VALEUR	C-2 VALEUR	C-3 VALEUR	C-4 VALEUR	C-5 VALEUR	VALEUR TOUS	DEPENSES INTRS.	'VALEUR NET	VALEUR NET PAR HA.	VALEUR / P-J TRAV.
202	2.6990	103	103	0	0	1.920	0.960	0.000	0.000	0.000	115.200	62.400	0	0		177.600	0	177,600	65,802	639
203	1.1275	140	140	0	0	0.960	0.600	0.000	0.000	0.000	57.600	39,000	0	0		96,600	0	96,600	85,676	612
204	0.3759	101	101	0	0	1.260	0.000	0.000	0.300	0.000	75,600	0	0	56,000		131,600	0	131,600	350,093	3,466
206	0.5249	96	96	0	0	0.360	0.000	0.000	0.000	0.000	21,600	0	0	0		21,600	0	21,600	41,198	429
301	0.4996	53	58	0	0	0.960	0.000	0.000	0.345	X	3,600	0	0	21,390	38,350	63,340	3,650	59,690	119,715	2,064
302	0.1885	21	21	0	0	0.050	0.000	0.000	0.000	X	3.000	0	0	0	3,000	6,000	350	5,650	30,005	968
303	0.3313	92	85	7	4,350	0.300	0.000	0.000	0.450	X	18.000	0	0	26,660	27,000	71,660	600	71,053	214,467	2,331
401	0.0839	92	92	0	0	0.225	0.000	0.000	0.204		13.500	0	0	12,958		26,458	0	26,458	315,728	3,432
402	0.3229	134	134	0	0	0.180	0.000	0.000	1.130	X	10.800	0	0	73,160	22,000	105,960	0	105,960	328,151	2,449
404	0.1135	52	52	0	0	0.135	0.000			X	8.100	0	0	0	5.000	13.100	0	13,100	115,419	2,220
504	0.1544	59	59	0	0	0.270	0.000	0.000	0.000		16.200	0	0	0	2.000	18.200	0	18,200	117.376	1,998
505	0.2725	72	72	0	0	0.405	0.000	0.000	0.000	0.000	24.300	0	0	0		24.300	0	24,300	89,273	1,240
506	0.5002	33	33	0	0	0.225					13.500	0	0	0		13.500	0	13,500	26,993	710
601	0.3104	134	131	3	1,200	0.000	0.000	0.000	0.000	X	0	0	0	3,100	11.000	14.100	0	14,097	45,416	339
701	1.0770	72	72	0						X	0	0	0	0	54.000	54,000	0	54,000	50.139	696
703	0.2244	41	41	0		0.150				X	9.000	0	0	2	20.000	29,000	0	29,000	129,234	3,152
704	0.4521	93	92	1	1.500	0.300					18,000	0	0	0		18,000	0	17,999	39,812	490
TOT	9.2558	1295	1287	11	7050	6.6000	1.5600	0.0000	3.0140	0.0000	408,000	101,400	0	193.268	182,350	885,018	4,600	880,407	2,164,392	37,225
MOY	0.5445	82															511	51788.65	127352.5	1601.458
	P-J/HA.= 151.04															CFA/ER.HA	497			1548.698
voir seaFOS12 calc			P-J./h								0	0	0	0		0		0	127.352	ERR

CONTRE-SAISON IRRIGUEE — PRODUCTION EN TONNES

CON						C-1 MAIS	C-2 SORGHO	C-3 ONION	C-4 PATATE	C-5 AUTRE	C-1 VALEUR	C-2 VALEUR	C-3 VALEUR	C-4 VALEUR	C-5 VALEUR	VALEUR TOUS	DEPENSES INTRS.	'VALEUR NET	VALEUR NET PAR HA.	
101	0.2458	71	58		1220.000	0.065	0.000	0.000	0.000	0.000	3.900		0	0		3,900	1.862	2,025	5,856	85
104	0.3222	50	49	1	750	0.000	0.000	0.250	0.000	0.000	0	0	62.500	0		62,500	2,500	59,999	152,525	3,056
105	0.0239	47	45	2	1,500	0.050	0.000	0.000	0.000	0.000	3,000	0	0	0	2,500	5,500	2,129	3,369	116,979	2,489
401	0.9920	47	47	0	0	0.000	0.000	0.150	0.000	X	0	0	37,500	0	2,500	40,000	2,500	37,500	37,802	804
402	0.1216	44	44	0	0	0.000	0.000	0.300	0.000	X	0	0	75,000	0	2,500	77,500	3,750	73,750	606,497	13,794
403	0.1345	17	17	0	0	0.000	0.000	0.275	0.000	X	0	0	68,750	0	2,500	71,250	2,500	68,750	510,773	30,045
405	0.0625	59	59	0	0	0.000	0.000	0.440	0.000	0.000	0	0	110,000	0		110,000	1,250	108,750	1,740,000	29,492
406	0.0795	46	46	0	0	0.000	0.000	0.050	0.000		0	0	12,500	0		12,500	1,250	11,250	143,130	3,112
504	0.1408	154	154	0	0	0.225	0.000	0.000	0.000	0.000	13.500	0	0	0	0	13,500	4,800	8,700	61,790	401
505	0.1405	110	110	0	0	0.292	0.000	0.000	0.000		17,550	0	0	0		17,550	8,800	8,750	62,145	565
506	0.1162	44	44	0	0	0.225	0.000	0.000	0.000		13,500	0	0	0		13,500	3,200	10,300	88,640	2,015
TOT	2.5543	689	673	16	22250	0.8575	0.0000	1.4650	0.0000	0.0000	51,450	0	366,250	0	10,000	427,700	34,541	393,143	3,526,436	85,845
AVG	0.2322	63	61	1	2023	0.0780	0.0000	0.1332	0.0000	0.0000	4.677	0	33,295	0	2,000	38,882	3,140	35,740	320,585	7,804
	P-J/HA: 269.74															EX.CFA.HA	13.523			5.118

SITUATION:	EJANVIE 1990					EN JUIN 1990				
CO.NO.	ASIN.	EQUIN.	BOVIN.	OVIN	CAPRIN.	ASIN.	EQUIN.	BOVIN	OVIN	CAPRIN
DIAWARA										
101	0	1	0	2	0 X	2	1	0	2	0
102	2	0	2	20	0 X	0	0	0	2	0
103	2	0	2	3	5 X	3	0	3	4	0
104	2	3	0	9	0 X	2	1	0	5	0
105	0	1	7	14	0 X	0	1	0	7	0
106	1	0	0	0	0 X	1	0	0	2	0
201	5	0	17	2	0 X	4	0	0	16	0
202	2	0	0	0	0 X	3	1	5	0	0
203	3	2	0	0	0 X	0	1	0	5	0
204	0	1	0	27	0 X	0	0	0	3	0
205	5	0	0	15	0 X	5	0	0	10	0
206	4	5	0	28	0 X	4	5	0	25	0
301	0	0	0	0	0 X	0	0	0	0	0
302	2	0	6	6	0 X	2	0	4	2	0
303	3	0	0	11	0 X	4	0	0	3	0
304	0	0	0	0	0 X	0	0	0	0	0
305	2	0	7	4	0 X	2	0		6	0
306	0	0	5	0	0 X	1	0	3	2	0
401	2	0	60	131	0 X	2	0	51	110	10
402	3	1	10	2	1 X	2	1	6	1	0
403	2	0	0	0	13 X	2	0	0	0	12
404	0	0	2	0	4 X	0	0	2	0	2
405	4	0	4	25	5 X	3	0	15	21	12
406	3	1	48	20	15 X	4	0	7	12	1
502	4	3	7	0	0 X	2	2	7	0	0
503	5	2	0	4	11 X	5	2	0	3	10
504	2	0	0	0	10 X	2	0	0	0	8
505	2	2	10	0	22 X	2	1	6	5	17
506	2	1	3	2	0 X	2	1	0	1	0
TOT:	62	23	190	325	80 0	59	17	109	247	76
MOY:	2.1	0.8	6.6	11.2	3.0***	2.0	0.6	3.9	8.5	2.6
%diff=	-5%	-26%	-43%	-24%	-12%					

	A	E	B	O	C	A	E	B	O	C
NAYE										
CO.NO.										
601	1	0	22	4	3 X	1	0	32	6	3
602	1	0	15	6	4 X	0	0	9	5	3
603	3	0	61	8	6 X	1	0	51	8	6
604	0	0	0	0	4 X	0	0	0	2	1
606	1	0	52	4	8 X	1	0	41	7	8
701	0	0	0	0	0 X	0	0	1	0	3
702	1	0	0	15	20 X	1	0	0	8	12
703	0	0	0	0	10 X	0	0	0	0	6
704	1	0	0	2	0 X	1	0	0	2	0
705	1	0	0	0	6 X	1	0	0	0	5
706	0	0	8	40	10 X	1	0	5	29	10
TOTAL	9	0	158	79	73 X	7	0	142	77	57
MOY:	1.5	0.0	26.3	13.2	12.2	1.2	0.0	23.7	12.8	9.5
%diff=	-22.2%	ERR	-10.1%	-2.5%	-21.9%					

SUMMARY TABLE 1 TAB.WKI 7-89 TO6-90 INCL.

ANNEX "A" P.1

POP CON	NO EMS	CON.#	DONS ET MANDATS F.CFA.	EMPLOIS F.CFA.	TYPE	VENTE PRODUITS	DETAIL	MANDATS P-C. %	EMPLOIS P-C. %	PRODUITS P-C. %	TOTAL F.CFA.	PRODUITS AGRICOLES
		DIAWARA										
24	2	101	391,725	0	0	0	0	100%	0%	0%	391,725	0
13	1	102	159,710	1,320,000	MAISONDER	0	0	13%	57%	0%	1,509,710	0
35	6	103	1,508,250	0	0	0	0	100%	0%	0%	1,508,250	0
39	2	104	533,000	5,070,375	MAISONDER	11,500	0	14%	85%	1%	5,947,875	11,500
16	2	105	505,500	1,110,000	MAISONDER	25,500	0	30%	65%	2%	1,671,000	25,500
16	1	106	52,000	4,200	MARABOUT	0	0	95%	5%	0%	56,200	0
143	11	TOTALS	3,510,215	7,531,575		73,000	0	32%	68%	1%	11,117,790	73,000
24	2	MOYEN	555,036	1,255,761		12,167	0	32%	68%	1%	1,552,965	12,167
		YELINGARA										
23	5	201	601,400	0	CHEF DE V	0	0	100%	0%	0%	601,100	0
28	7	202	1,351,900	114,500	PENSION	190,000	190,000	82%	7%	11%	1,656,100	0
25	10	203	911,000	30,000	BOUTIQUE	0	0	97%	3%	0%	911,000	0
16	3	204	355,000	0		126,000	0	75%	0%	25%	511,000	126,000
22	3	205	165,000	0		0	0	100%	0%	0%	165,000	0
19	2	206	1,025,500	0		50,000	0	95%	0%	5%	1,075,500	50,000
121	33	TOTALS	4,715,500	144500		366,000	0	90%	3%	7%	5,259,300	366,000
20	6	MOYEN	791,467	24,083		61,000	0	90%	3%	7%	876,550	61,000
												0
TOT GOYE I:			5,259,015	7,679,075		139,000		50%	47%	3%	16,377,090	439,000

POP CON	NO EMS	CON.#	DONS ET MANDATS F.CFA.	EMPLOIS F.CFA.	TYPE	VENTE PRODUITS	DETAIL	P-C. % MANDATS	P-C. % EMPLOIS	P-C. % PRODUITS	F.CFA. TOTAL	PRODUITS AGRICOLES
		BAKEL										
11	1	301	0	531,500	MASON	7,000	0	0%	99%	1%	541,500	7,000
11	1	302	100,000	16,500	MENUISIER	0	0	85%	32%	0%	116,500	0
35	4	303	1,110,000	0		0	0	100%	0%	0%	1,110,000	0
9	0	304	0	59,200	OUVRIER	15,000	0	0%	55%	15%	107,200	15,000
16	1	305	335,000	0		0	0	100%	0%	0%	335,000	0
7	0	306	0	49,500	PENSION	69,850	1,250	0%	41%	59%	119,350	65,600
92	7	TOT/MOY:	1,545,000	959,700		121,850	1,250	58%	37%	5%	2,659,550	120,600
15	1		257,500	161,950		20,505	705	58%	47%	5%	111,255	20,100
												0
		AROUNDOU										
31	2	401	459,950	0		29,000	0	94%	0%	6%	515,950	29,000
19	1	402	306,000	0		147,500	0	65%	0%	33%	453,500	147,500
7	1	403	13,500	0		39,100	0	26%	0%	74%	52,600	39,100
9	1	404	50,000	0		73,500	17,500	40%	0%	60%	123,500	56,000
28	2	405	125,000	0		222,000	198,000	66%	0%	34%	647,000	24,000
20	3	406	30,000	0		204,500	162,500	13%	0%	87%	234,500	42,000
111	10	TOTAL	1311450	0		715,600	378,000	65%	0%	35%	2,030,050	337,600
19	2	MOYENNE	219,050	0		119,267	63,000	65%	0%	35%	338,347	56,267

POP CON	NO EMS	CON.#	DONS ET MANDATS F.CFA.	EMPLOIS F.CFA.	TYPE	VENTE PRODUITS	DETAIL	P-C. % MANDATS	P-C. % EMPLOIS	P-C. % PRODUITS	F.CFA. TOTAL	PRODUITS AGRICOLES
		BALLOU										
31	1	502	0	535,000	MAISONDER	60,000	60,000	0%	93%	7%	595,000	0
25	7	503	660,575	0		5,000	5,000	99%	0%	1%	665,575	0
11	1	504	106,500	0		73,500	13,500	59%	0%	41%	180,000	60,000
32	7	505	235,500	70,500	STAGESAED	5,000	0	76%	23%	2%	311,000	5,000
12	6	506	711,000	0	0	0	0	100%	0%	0%	711,000	0
111	22	TOTAL	1,716,575	905,500		146,500	81,500	62%	33%	5%	2,768,575	65,000
22	1	MOYEN	311,375	181,100		29,300	16,300	62%	33%	5%	553,775	13,000

ANNEX "A" P. 2

	PRODUITS AGRICOLES P-C. %	P.AGRIC. P-C. % T.PRODUITS	CFA/ CAPITA	CFA MAN. EMIGRE	/EMPLOIS CFA./ CAPITA	PRODUITS CFA./ CAP	MANDATS CFA./ CAPITA
DIAWARA							
101	0%	ERR	16,322	195,563	0	0	16,322
102	0%	ERR	116,134	159,740	101,535	0	14,595
103	0%	ERR	43,093	251,375	0	0	43,093
104	1%	100%	152,510	116,500	130,010	1,111	21,359
105	2%	100%	101,625	252,750	71,250	1,781	31,591
106	0%	ERR	5,355	52,000	263	0	5,125
TOTALS	1%	100%	77,747	250,730	52,659	510	24,547
MOYS	1%	100%	77,717	250,730	52,659	510	24,547
YELINGARA							
201	0%	ERR	26,275	75,550	0	0	26,275
202	0%	0%	59,157	193,129	4,069	6,756	48,262
203	0%	ERR	72,615	91,400	2,308	0	70,305
204	25%	100%	31,935	126,333	0	7,575	24,063
205	0%	ERR	21,136	155,000	0	0	21,136
206	5%	100%	56,763	514,250	0	2,632	54,132
TOTALS	7%	100%	43,465	143,903	1,194	3,025	39,246
MOYS	7%	100%	43,465	143,903	1,194	3,025	39,246
	3%	100%					
CON BAKEL							
301	1%	100%	60,107	0	59,607	500	0
302	0%	ERR	13,315	100,000	4,227	0	9,091
303	0%	ERR	31,714	277,500	0	0	31,714
304	45%	100%	11,911	0	6,578	5,333	0
305	0%	ERR	20,935	335,000	0	0	20,935
306	55%	94%	17,050	0	7,071	9,979	0
TOT/MOY:	5%	97%	25,905	220,714	10,755	1,357	16,793
	5%	97%	25,905	220,714	10,755	1,357	16,793
AROUNDOU							
401	6%	100%	16,741	211,990	0	935	15,506
402	33%	100%	23,565	306,000	0	7,763	16,105
403	71%	100%	7,511	13,500	0	5,556	1,929
404	45%	76%	13,722	50,000	0	8,167	5,556
405	4%	11%	23,107	212,500	0	7,929	15,179
406	19%	21%	11,725	10,000	0	10,225	1,500
TOTAL	17%	47%	17,505	131,115	0	6,277	11,531
MOYENNE	17%	47%	17,505	131,445	0	6,277	11,531
CON.# BALLOU							
502	0%	0%	25,571	0	26,935	1,935	0
503	0%	0%	26,755	91,411	0	320	26,435
504	33%	52%	16,364	106,500	0	6,652	9,652
505	2%	100%	9,719	33,613	2,203	156	7,359
506	0%	ERR	59,500	119,000	0	0	59,500
TOTAL	2%	44%	24,945	75,040	5,155	1,320	15,467
MOYEN	2%	44%	24,945	75,040	5,155	1,320	15,467
CON.# NAYE							

	NO EHS	CON.# NAYE	DONS ET MANDATS F.CFA.	EMPLOIS F.CFA.	TYPE	VENTE PRODUITS	DETAIL	P-C. % MANDATS	P-C. % EMPLOIS	P-C. % PRODUITS	F.CFA. TOTAL	PRODUITS AGRICOLE
		NAYE										
8	1	601	150,000	31,200	FORMATION	87,500	72,500	60%	11%	29%	301,700	15,000
10	1	602	152,175	0		115,100	97,000	56%	0%	44%	270,875	21,400
19	3	603	423,000	300,060	COTHERCI	86,500	15,000	52%	37%	11%	809,500	11,500
6	1	604	39,900	225,000	MASON	15,000	15,000	14%	80%	5%	279,900	0
25	1	606	311,150	0		76,000	0	82%	0%	18%	417,150	76,000
68	7	TOTAL	1,136,525	559,200		183,100	229,500	55%	27%	18%	2,079,125	153,900
14	1	MOYEN	227,305	111,840		76,650	15,900	55%	27%	18%	415,625	30,750
		GUITA										
5	1	701	0	60,000	BERGER	115,500	0	0%	34%	66%	175,500	115,500
4	0	702	0	50,000	BERGER	143,500	59,000	0%	26%	74%	193,500	64,500
11	1	703	0	65,000	BERGER	51,500	56,000	0%	44%	56%	116,500	25,500
5	1	704	30,000	50,000	BERGER	87,000	87,000	18%	30%	52%	167,000	0
4	0	705	0	70,000	BERGER	95,720	54,500	0%	41%	59%	168,720	44,220
20	1	706	117,500	50,000	BERGER	219,000	219,000	28%	12%	60%	416,500	0
52	4	TOTAL	147,500	315,000		775,220	505,500	12%	27%	61%	1,270,720	272,720
9	1	MOYEN	24,583	57,500		129,703	84,250	12%	27%	61%	211,757	45,453
		SOMMAIRE TOTAL GOYE	12,535,370	9,574,275		1,425,950					23,835,595	
701	97	TOTAL	11,119,395	10,476,175	0	2,557,570					27,185,440	
18	2	MOYEN	352,985	361,962	0	64,689		52%	39%	10%	679,636	

ANNEX "A" P. 3

NAYE							
601	5%	17%	37,713	150,000	4,275	10,949	22,500
602	5%	15%	27,055	152,475	0	11,540	15,245
603	5%	48%	42,605	111,000	15,759	1,551	22,263
604	0%	0%	46,650	39,900	37,500	2,500	6,650
606	18%	100%	16,686	341,150	0	3,040	13,646
TOTAL	7%	40%	30,575	162,361	5,224	5,635	16,714
MOYEN	7%	40%	30,575	162,361	5,224	5,635	16,714
GUITA							
701	66%	100%	22,313	0	7,500	14,513	0
702	44%	59%	45,375	ERR	12,500	35,575	0
703	17%	31%	13,315	0	5,909	7,409	0
704	0%	0%	33,100	30,000	10,000	17,100	6,000
705	26%	45%	42,150	ERR	17,500	24,650	0
706	0%	0%	20,625	117,500	2,500	12,450	5,575
TOTAL	21%	35%	24,137	36,575	6,635	14,966	2,537
MOYEN	21%	35%	24,137	36,575	6,635	14,966	2,537
TOTAL	TOUS:		247,865	115,561	14,945	3,691	20,142
MOYEN	TOUS:		6,197	3,639	14,946	3,691	20,142

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