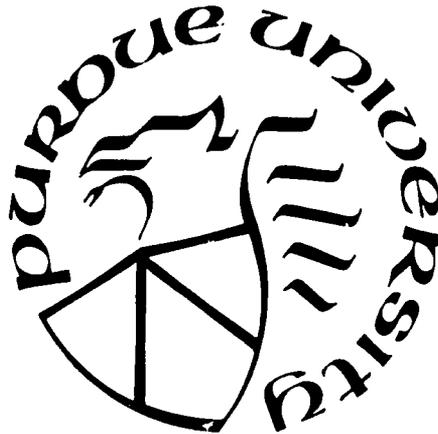
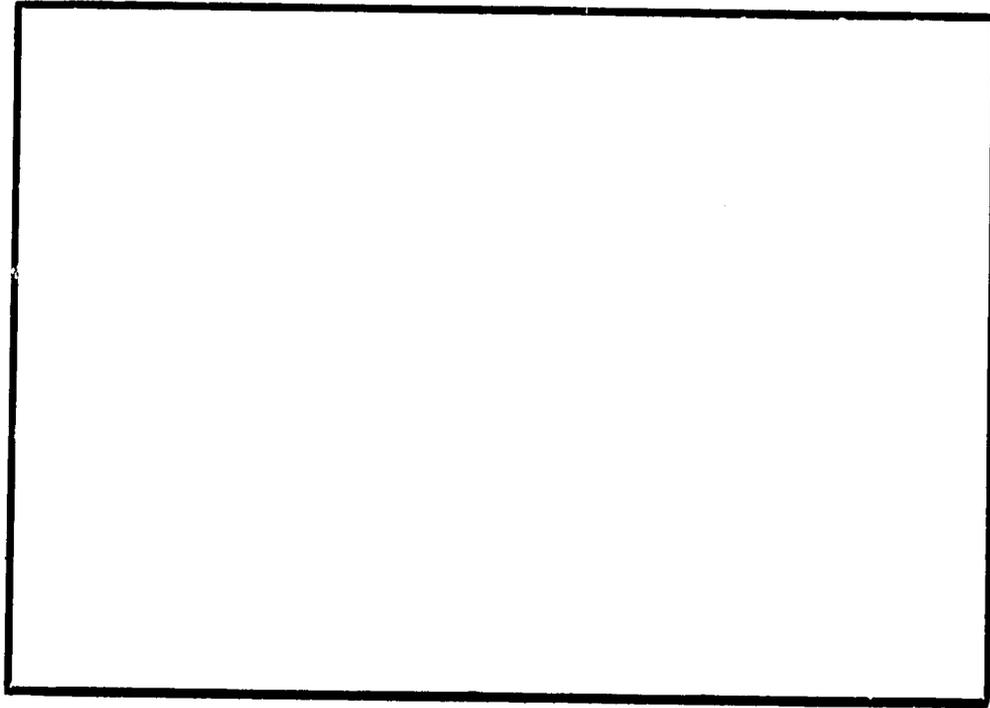


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DEPARTMENT OF AGRICULTURAL ECONOMICS

**Purdue University
West Lafayette, Indiana**

The Volta Valley Authority:
Socio-Economic Evaluation of a
Resettlement Project in Upper Volta

by
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FOREWORD

This study is based on fieldwork accomplished by Josette Murphy and Leendert H. Sprey in Upper Volta between June 1977 and February 1980. Dr. Murphy is a member of the West African team of the department of Agricultural Economics of Purdue University (U.S.A.); her work is financed by USAID Sorghum-Millet Research Project AID/AFR-C-1257. L.H. Sprey is a member of the International Institute for Land Reclamation and Improvement, the Netherlands; his work is financed by the Office for International Technical Assistance of the Netherlands.

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PART I
INTRODUCTION

1. Origin and Goal of the Volta Valley Authority

In 1973, the World Health Organization implemented an intensive program to control onchocerciasis in seven countries of West Africa (Ivory Coast, Ghana, Togo, Benin, Niger, Mali, and Upper Volta). At the regional level, this program includes long term spraying of the river areas with abate, a biodegradable organophosphate, in order to bring the population density of the vector of the disease below a critical level. Research teams are monitoring the effect of lowering the vector population on the health of the local population and searching for a cure for the disease. With the vector now under control, large areas of river valleys which had been sparsely populated have become available for settlement and economic development, each country involved devising its own development strategy.

In Upper Volta, the disease was prevalent mostly in the valleys of the Volta rivers and their tributaries, in the south and southwest of the country. This area had remained sparsely inhabited although its soils are relatively more fertile than those of the Central Plateau, where over-population has been lowering soil fertility.

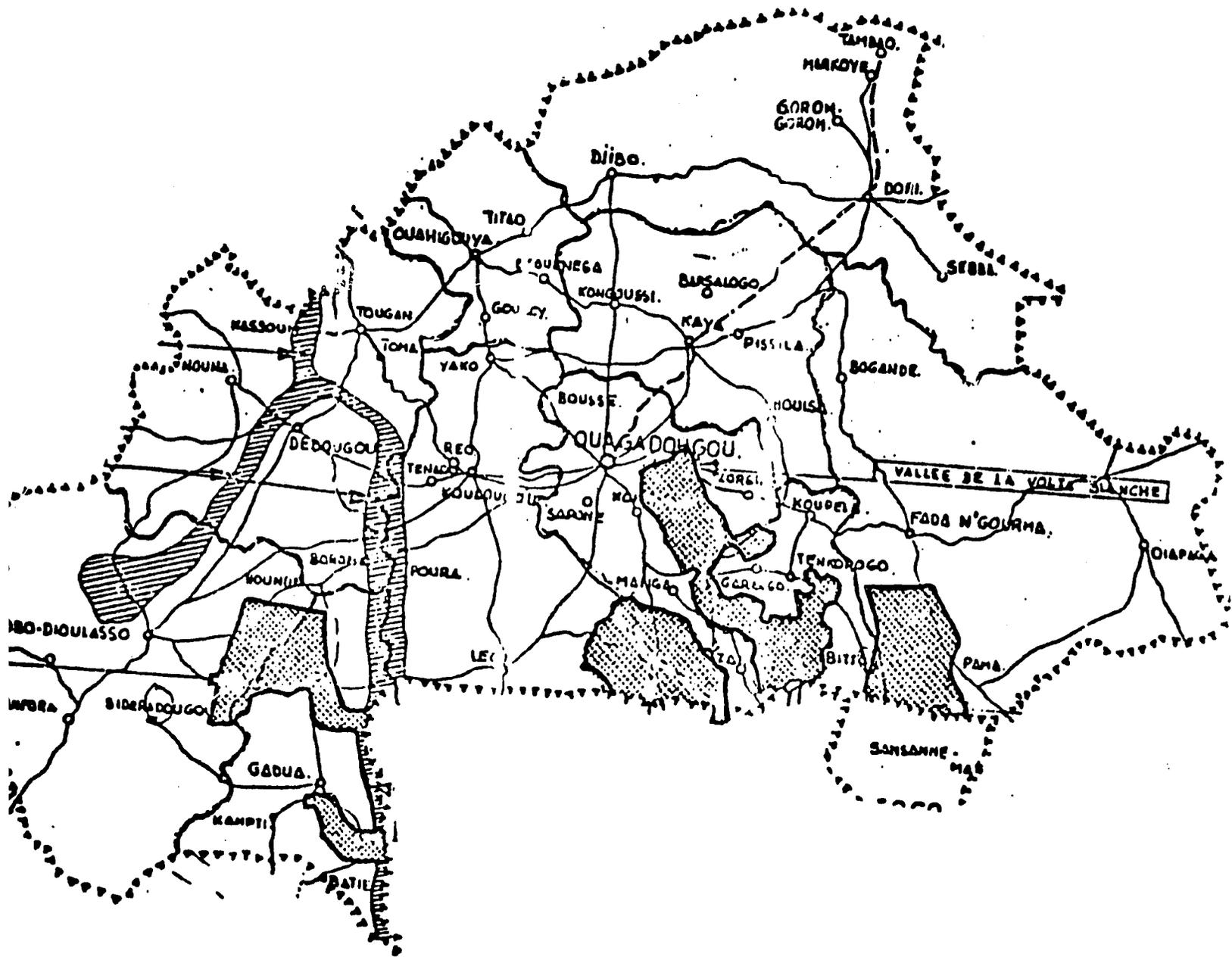
In September 1974 the government of Upper Volta created the Volta Valley Authority (AVV)*, a state agency that has full control over a territory of nearly 30,000 km², almost 12% of the country (see map 1). The AVV received the following mandate:

- To organize the settlement of volunteer families in the Volta Valleys thus relieving population pressure on the Mossi Plateau; 20,000 families are to be settled in dry land agriculture, 32,000 in irrigated agriculture.
- To promote the use of improved farming techniques that will bring maximum production while minimizing ecological damage and preserving soil fertility, and so provide a regional cereal surplus.
- To set aside natural reserves and forests in which wildlife will be protected and to implement a reforestation program which will provide a continuous supply of firewood (badly needed in the capital).

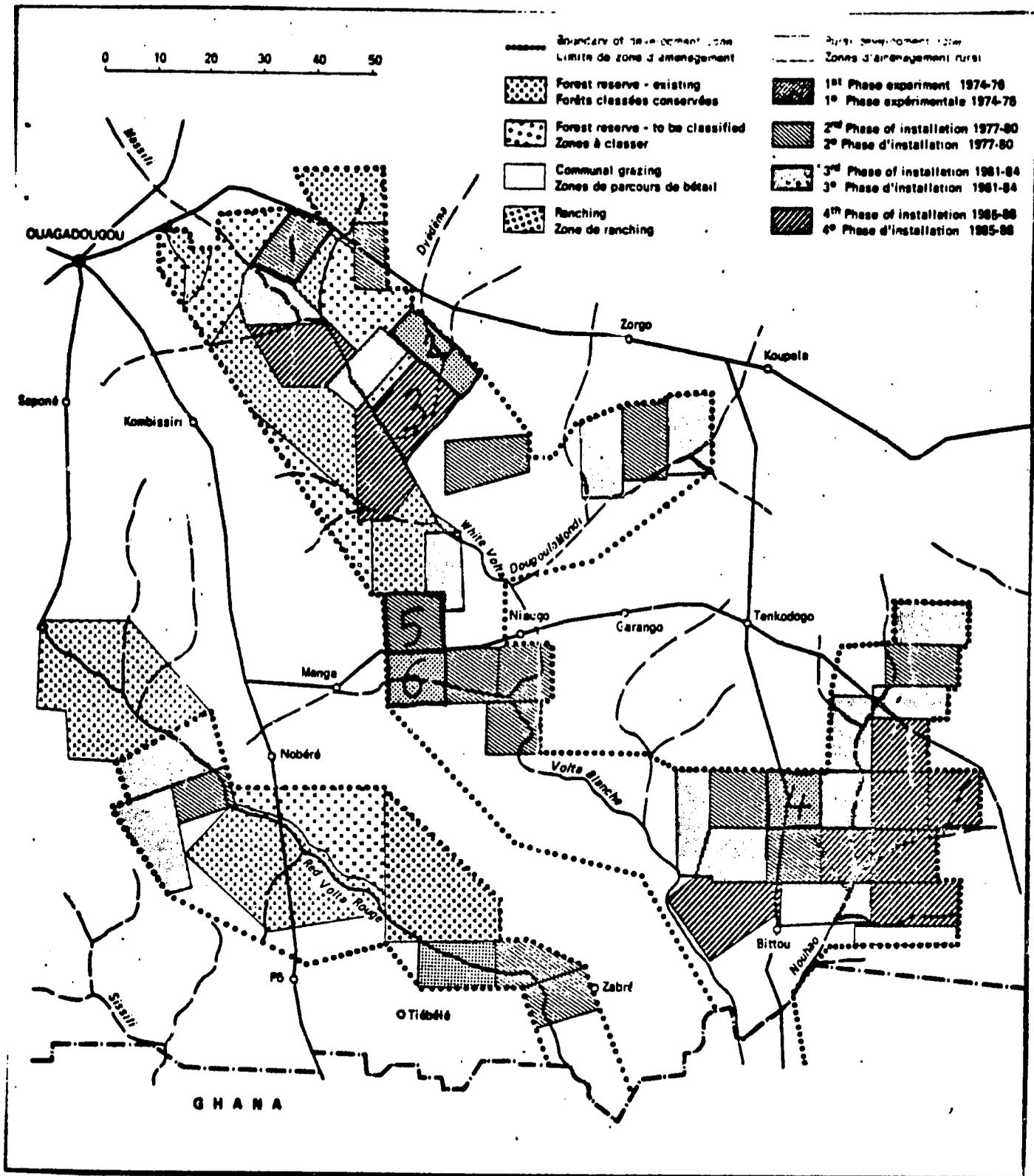
The areas of the White and Red Volta, where most of the settlement had taken place as of 1979, is located between 11° and 12°30 latitude North, in the Ouagadougou and Koupela ORD's** (see Map 2). The climate is Sudanic, with an average rainfall between 800 and 1000 mm. Millet and sorghum are the staple crops.

* AVV: Autorité des Aménagements des Vallées des Volta

** ORD: Organisme Regional de Developpement.



Map 1. Upper Volta: the shaded areas are under the control of the AVV
From Programme Global d'Etudes et d'Investissements de l'Autorité des Aménagements des Vallées des Volta.



Map 2. Location of the AVV clusters of villages discussed in this paper.

. 1=Linoghin, 2=Mogtedo, 3=Bomborè, 4=Banè, 5=Kaibo Nord, 6=Kaibo Sud.

1+2+3=north zone, 5+6=center zone, 4= south zone.

The technical package and the administrative structure of the AVV were designed by French experts (mostly from the IRAT*, a French institute for agronomic research in the tropics). The AVV, now part of the Ministry of Plan, is financed for 85% through grants from several donor countries, mostly France, the Netherlands, and the European Community.

2. Structure of the AVV

The AVV selects the sites for the new villages and it identifies the plots which will be put under cultivation. Ideally, the infrastructure of a new village is set up before the settlers' arrival; it includes a road system, a warehouse, a school and a dispensary for each cluster of villages, wells, and housing for the AVV agents at the village level.

The AVV advertises throughout the country and selects the settlers from among volunteer candidates. The basic requirement is the size and stability of the labor force: the family must include at least two adult workers, preferably more, including at least one married couple. The husband is always considered to be the household head in dealing with the AVV. As a rule, it is not a whole compound (one man, his wives, his married sons, their wives and children) that migrates but only a ménage (one man, one or several of his wives and some unmarried children); other members of the compound might join them in the following years.

The AVV brings the families to the new villages in January or February, about three months before the beginning of the rainy season. Each family must first clear and destump a one-hectare plot in the village on which to build its compound. It also receives two fields on which cotton and sorghum will be planted soon after the first rain. The AVV organizes a very intensive program of agricultural extension with, for the first five years, one extension agent for every 25 families and one female extension agent for every 50 families. This program, which will be fully described in Part II, includes the use of chemical inputs and animal traction, for which the AVV has set up its own Credit unit.

Until the first harvest, each family receives a food donation from the World Food Program of the United Nations. The ration in 1979 consisted of 500 grams of sorghum, 40 grams of canned fish, 30 grams of oil and 30 grams of milk powder enriched with vitamins A and D per person per day. This amounts to 2200 calories. Through 1979, young children were allocated a partial ration when calculating the supply to be received by a family, but each will be included as a full person from 1980 on.

In addition to extension and credit, the AVV provides services not directly tied to farming activities. A three-classroom primary school will be built in a central location in each cluster, one classroom being built every two years. Each class opens with about 60 boys and girls of ages 6 and 7. The AVV takes charge of building the school and housing for the teachers, and it provides classroom furniture. The Ministry of Education appoints the teachers, finances their salaries, and is supposed to provide the needed educational material. The school is opened for children of AVV settlers and of local

* IRAT: Institut de Recherche Agronomique Tropicale and des Cultures Vivrières

farmers. Attendance is free but not mandatory. The children receive a free lunch provided by Catholic Relief.

The AVV has a similar type of cooperation with the Ministry of Health to provide one dispensary for each cluster of villages. The AVV provides the buildings, the Ministry appoints the nurse, UNICEF provides some equipment. The dispensary is opened to local people as well as to AVV settlers. The AVV has organized the training of one midwife per village. The villagers choose the woman, who is trained during two one-month periods in a maternity clinic and is given some basic equipment by UNICEF. The villagers also build a delivery hut. The villagers also choose one person per village who participates in a one-week training session in first aid. During the rainy season, pregnant women and children under five are given anti-malarial drugs.

The AVV provides one assistant-veterinarian in each cluster of villages or at least someone with enough training to give inoculations and basic care to the oxen. The farmer pays only part of the cost for the needed drugs. Local farmers will now have access to veterinarian care in the same conditions. Under an ILO program, the AVV provides additional training for one blacksmith per cluster of villagers, who can repair the agricultural implements used by the settlers.

The villagers are eager to have a mill available close by, as the crushing of cereals into the flour which is the basic staple of their diet is very time consuming. The AVV has been providing fuel powered grinders; the villagers set up a building for the mill and hire someone to run it.

The settlers also receive free seedlings (mostly eucalyptus) to plant around their compounds and between the fields. The AVV is in charge of a 7,000 ha reforestation area 60 km east of Ouagadougou. About 1,500 ha have already been planted, mostly with eucalyptus and a few neems and melinas. Trees will become available for use as fuel wood and construction wood in 1983. There are restrictions on cutting trees for firewood in the AVV territory, but this is difficult to enforce.

3. The AVV population

In July 1977, when this study began, 905 families were living in 26 villages, a total of about 6,100 people. By 1979, the AVV population had increased to 1,700 families living in 47 villages, for a total population of about 14,000 people. Basic characteristics of the AVV population were identified during a detailed census in 1977. The majority of settlers are Mossi (Table 1), the main ethnic group in Upper Volta, and they come from the more densely populated ORD's of the country (Table 2).

TABLE 1. Main ethnic groups of AVV population in 1977.

Ethnic group	Percentage of AVV population	Percentage of Upper Volta population*
Mossi	66	50
Bissa	15	5
Kassena	11	6
Dagari	3	[about 2]
Fulani	3	5
Others	2	[about 32]

TABLE 2. ORD of origin of the AVV farmers in 1977.

ORD of origin	Percentage of AVV population	Population Density of the ORD
Ouagadougou	40	46.1
Koupela	23	38.5
Ouahigouya	14	46.2
Kaya	13	31.4
Koudougou	3	32.4
Others	7	--

The AVV population is young (Table 3), with a median age of 16; the birth rate of AVV settlers in 1977 was almost double the national average (3.7% versus 2%). The sex ratio is almost equal (51% males). In spite of its youth, 65% of the population reports participating in agricultural work.

TABLE 3. Distribution of AVV population among age classes in 1977.

Age	Percentage of AVV Population
0 - < 10	36
10 - < 20	22
20 - < 30	15
30 - < 40	13
40 - < 50	7
50 - < 60	4
60 +	3

median: 16

The AVV population is mostly of Moslem religion (47%), while Christians and animists are equally represented (26 and 27%, respectively). About 10% of the population has gone to school (Table 4), most often to a coranic or a primary school.

*According to IFDC, (International Fertilizer Development Centre), 1977.

TABLE 4. Type of schooling received by the 10% of AVV settlers who have gone to school (1977)

Type of School	Percentage of AVV population
Coranic school	45
Primary school	26
Adult education	9
Rural school	6
Other	14

An important part of the heads of household had migrated previously to AVV, most of them outside of Upper Volta (mainly Ivory Coast and Ghana).

The average number of people per AVV farm has been increasing, from about 6.7 in 1977 to 8.2 in 1979. This growth reflects both a high birth rate and the arrival of kin who come and join the AVV compound after one or two crop seasons. Yet the number of people per farm is still small compared to the national average of 11.6 people per rural compound found in the 1975 national census.

PART II

THE AGRICULTURAL PROGRAM PROMOTED BY AVV

1. Acreage and Crop Rotation

The creation of an AVV farm takes place over five years (see Table 5 and Map 3). Upon arrival, the settler receives a 1 ha plot in the village and two plots of 1.5 ha each in the bush. The family first clears and destumps the village plot and builds a compound. The farmer decides what he wants to cultivate in the garden around his compound and can use traditional techniques (including mixed cropping) if he wants.

One of the bush fields is destumped by the AVV equipment, but the farmer must clear the second field by hand. The two fields, one for cotton and one for white sorghum, are then plowed by an AVV tractor. The following years, each settler receives an additional field which he must destump by hand, but which is plowed by the AVV tractor. The settler buys a pair of oxen and the necessary equipment on credit after the first harvest, and plows the two fields he had received the first year with animal traction from then on.

This is repeated over the following three years, one new field being opened each year. The AVV farm reaches its full size in five years, but the fields are never all put under cultivation in a given year.

For each field an area of 1.5 ha is cleared, but the area actually put under cultivation depends upon the size of the labor force in the family. This potential for labor is measured by a labor index, calculated by weighting the number of persons in the family according to sex and age (see Table 6), an adult male being the standard unit of labor.

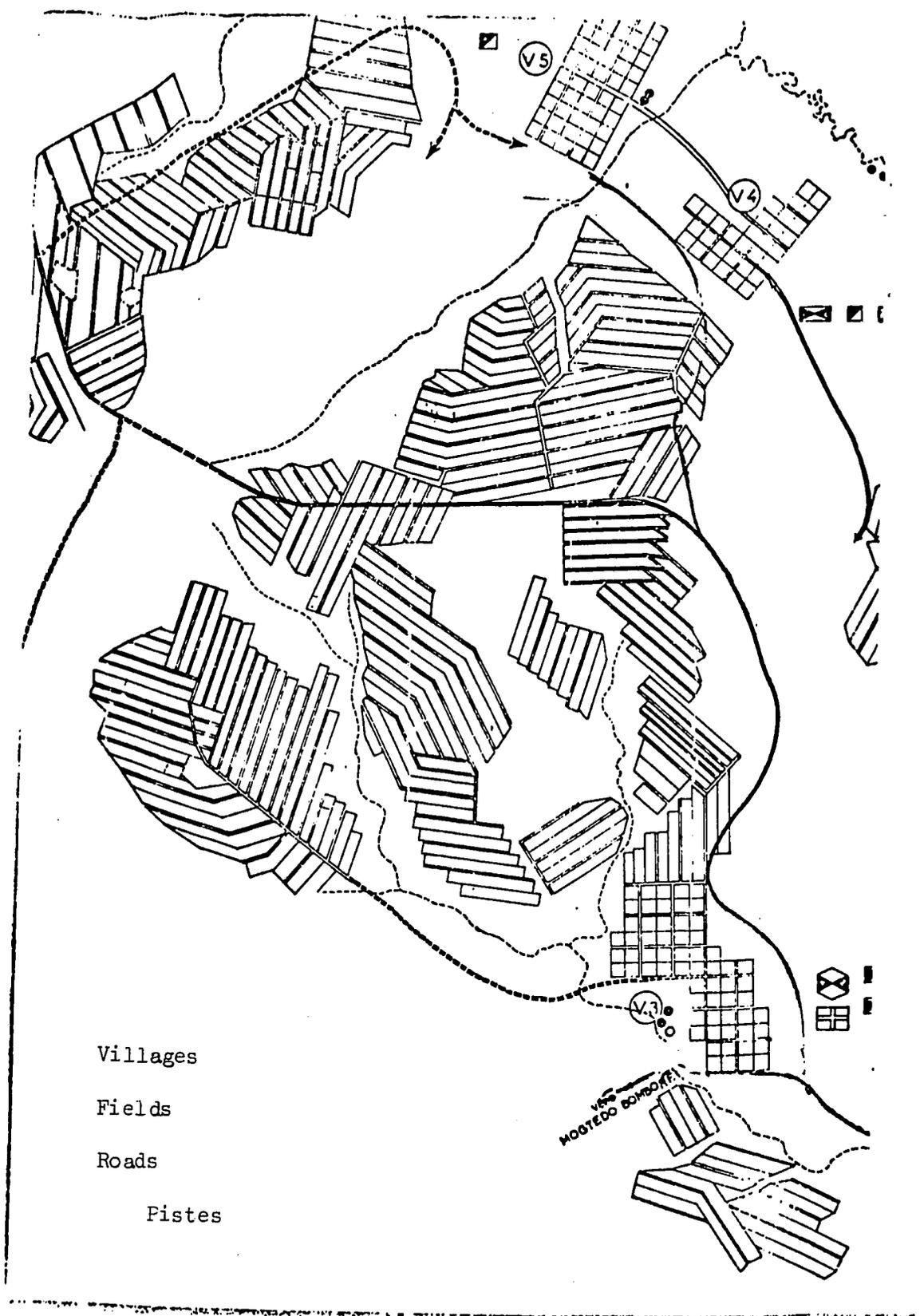
TABLE 6. Index of Labor Equivalentents by Sex and Age

<u>Age</u>	<u>Male</u>	<u>Female</u>
0 - < 12	--	--
12 - < 15	0.50	0.25
15 - < 55	1.00	0.75
55 - < 65	0.50	0.25

The area of the bush fields actually put under cultivation is such that each worker cultivates between 1.2 and 2.3 ha (including the village plot) or from 1 to 1.7 ha without the village plot (farm type I to V). The village plots are always 1 ha (2 ha for the very large families who receive a double farm).

Table 7 shows the increase in areas under cultivation and left fallow during the first five years (including the village plot) for the different types of farm (i.e. according to class of labor index).

The crop rotation depends upon the climatic zone in which each cluster of villages is located. The AVV distinguishes the North Zone



Map 3 Development of an AVV Farm (Example bloc of Magtedo)
(source AVV)

TABLE 5
Development of the AVV Farm

Location and Name of the Parcel		Village A	Bush B	Bush C	Bush D	Bush E	Bush F	Bush G
Area of parcel, ha		1,0	1,5	1,5	1,5	1,5	1,5	1,5
Year	Activities	Nature						
1	Clearing	Manual	Manual	Mechanical	Manual			
	Plowing	--	Mechanical	Mechanical	(October)			
	Crop maintenance	Manual	Manual	Manual	--			
	Construction of temporary house	Manual						
2	Clearing	--	--	--	--	Manual		
	Plowing	Ox traction	Ox traction	Ox traction	Mechanical	(October)		
	Crop maintenance	Ox traction	Ox traction	Ox traction	Ox traction	--		
	Construction of permanent house	Manual						
3	Clearing	--	--	--	--	--	Manual	
	Plowing	Ox traction	Ox traction	Ox traction	Ox traction	Mechanical	(October)	
	Crop maintenance	Ox traction	--					
4	Clearing							Manual
	Plowing	Ox traction	Fallow	Ox traction	Ox traction	Ox traction	Mechanical	(October)
	Crop maintenance	Ox traction		Ox traction	Ox traction	Ox traction	Ox traction	--
5	Plowing	Ox traction	Fallow	Fallow	Ox traction	Ox traction	Ox traction	Mechanical
	Crop maintenance	Ox traction			Ox traction	Ox traction	Ox traction	Ox traction

TABLE 7

Relationship Between Family Labor Index and Acreage Cultivated
During the First Five Years of the Farm

Farm Type	Labor Index	Area of Fields (ha)	FIELD OPENING					SITUATION IN YEAR FIVE			
			Year 1	Year 2	Year 3	Year 4	Year 5	Number of Fields	Total Area of the Farm (ha)	Area to Cultivate (ha)*	House Garden (ha)
Ia	1.75-2.25	1.50	2	1	1	1	1	6	9	3	1
Ib	2.50-3.25	1.50	2	1	1	1	1	6	9	4	1
II	3.50-4.50	1.50	2	1	1	1	1	6	9	5	1
III	4.75-5.75	1.50	2	1	1	1	1	6	9	6	1
IV	6.00-7.00	3.00	2	1	1	1	1	6	18	7	2
V	7.25-8.25	3.00	2	1	1	1	1	6	18	8	2
VI	8.50+	3.00	2	1	1	1	1	6	18	9	2

Source: AVV Extension Service

* without the house garden

(Linoghin, Mogtedo, Bombore), the Center Zone (Koulipele) and the South Zone (Bane, Tiebele and Djipologo) (see map 2).

The recommended crop rotation was modified several times between 1973 and 1977, but since 1978 changes have been made only in unusual situations. For example once it was decided to "freeze" the farms of a village to their previous size and a new field was not opened for the next crop year.

The rotation recommended since 1978 is shown in Table 8. The AVV focuses its effort upon the rotation of cotton, white sorghum, and legumes. The settler can also produce other crops as long as the cereals/legumes rotation is respected.

TABLE 8

Crop Rotation Recommended by the AVV

<u>Year</u>	<u>Northern Zone</u>	<u>Central and Southern Zones</u>
1	Cotton 1	Sorghum 1
2	Sorghum	Cotton 1
3	Cotton 2 - Peanuts Cowpeas	Red Sorghum - Cowpeas (maize-rice-soybeans)
4	Red Sorghum - Millet	Cotton 2 - Sorghum 2
5	Fallow	Fallow
6	Fallow	Fallow

2. Farming Techniques

2.1 General

The farming techniques to be used in the bush fields have been chosen by the AVV and are based upon six main innovations, all except animal traction must be used from the first year on:

- cultivation of cotton, a crop the settlers are not familiar with
- use of improved seeds, which can give higher yields if the planted fields are properly maintained
- mono-cropping and sowing in rows
- thinning
- use of chemical inputs (fertilizer and insecticides)
- use of animal traction (a pair of oxen) (from the second year on)

Furthermore, most of the settlers find themselves on different soils and in a different climatic zone from those in their village of origin.

These farming techniques imply a high level of investment on the part of the farmer. He can buy the necessary tools and inputs on credit with a loan from the AVV's Credit Unit at interest rates that vary with the duration of the loan. Small equipment and inputs are bought at the AVV warehouse. The settler pays cash, or for expenses over 2,000 CFA may buy on credit. He will then pay for everything after selling his cotton, but at a higher price.

The more expensive equipment (oxen and equipment) can be paid over seven years with an interest rate of seven percent (see II.2.4).

2.2 Inputs (variable costs)

For each crop, the AVV recommends the type and level of input to be used per hectare. One goal is to increase yields, so improved varieties of seeds are being introduced, but the program is not yet definitive and the technical package has been modified several times. For 1978, the following varieties were suggested for each cluster (see Table 9).

Cotton seeds are given free by the SOFITEX* and are renewed every year. The seeds for all other crops (sorghum, maize, cowpeas, etc.) are sold at the AVV warehouse for 95 CFA if charged or 90 CFA if paid for in cash, except for peanut seeds which cost respectively 75 or 70 CFA. These seeds are to be renewed every three years, except peanut seeds which are renewed every year. In the intervening years the farmer reserves seeds from his own production.

In 1979 the AVV required farmers to use 150 kg of fertilizer per ha (NPK 14:23:14) on the cotton while the same type of fertilizer is recommended for the sorghum. This level of fertilizer has been chosen to maintain soil fertility. On the other crops, the farmer is free to use fertilizer or not. This type of fertilizer costs 37 CFA per kg on credit or 35 CFA cash (SOFITEX subsidizes 50 percent of the cost of fertilizer). In 1979 the AVV recommended as an experiment that the fertilizer be applied just before the plowing of the field as this results in a more efficient use than when the fertilizer is applied at the first weeding (which is often done late).

Until 1978, the cotton was to be treated at least four times with a total of 10 liters of endrine-DDT per hectare. In 1979, about 50 percent of the farmers again used that insecticide, while the others used nuvacron, applied with an Ultra Low Volume sprayer which does not require water and is less time consuming. The nuvacron must also be applied at least four times, with a total of 12 liters per hectare. One liter of endrine costs 500 CFA on credit and 460 CFA cash, one liter of nuvacron

* Société pour le Développement des Fibres Textiles, which has a monopoly over the marketing of cotton in Upper Volta. The Voltaic government controls 51 percent of the shares, the remaining 49 percent are controlled by the CFDT, (Compagnie Française pour le Développement des Fibres Textiles), a French company.

TABLE 9

Varieties Recommended for Each Crop in the AVV
Clusters in 1978 and 1979

		Linoghin	Mogtedo, Bombore	Bane	Koulipele*	Tiebele	Djipologo
Cotton	1978	Cooker	SR1 F4	SR1 F1	Cooker	Cooker	Cooker
	1979	SR1 F4	SR1 F4	SR1 F4	SR1 F4	SR1 F4	SR1 F4
White Sorghum	1978	S29	S29	Gnofing	Ouedzore	Gnofing	Gnofing
	1979	S29	S29	Gnofing	Gnofing	Gnofing	Gnofing
Red Sorghum		local	local	local	local	local	local
Maize		--	Jaune de Fo	--	Jaune de Fo	Jaune de Fo	Jaune de Fo
Cowpeas		88-63	88-63	88-63	88-63	88-63	88-63
Rice		--	--	C74	--	C74	C74
Peanuts		TE3	TE3	--	--	--	--
		TS 32-1	TS 32-1	--	--	--	--
Millet		M9	--	--	--	--	--
Soybeans		--	--	G-38	--	--	--

*Kaibo Nord, Kaibo Sud, Manga Est.

Source: AVV Extension Service

TABLE 10

Quantity and Cost (price on credit, in CFA) of Inputs per Hectare
for Each Crop in the AVV Technical Package for the Years 1978 and 1979

Type	Cotton		White Sorghum		Red Sorghum		Maize		Cowpeas		Rice		Peanuts		Millet		Soybeans	
	Quant. kg.	Price CFA	Quant. kg.	Price CFA	Quant. kg.	Price CFA	Quant. kg.	Price CFA	Quant. kg.	Price CFA	Quant. kg.	Price CFA	Quant. kg.	Price CFA	Quant. kg.	Price CFA	Quant. kg.	Price CFA
Seed	40	--	13	1,235	13	1,235	25	2,375	25	2,375	80	7,600	80	6,000	5	475	40	3,800
NPK Fertilizer	150	5,550	150	5,550	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Insecticide*																		
Endrine (litres/ha)	10	5,000			--	--	--	--	--	--	--	--	--	--	--	--	--	--
Nuvacron (litres/ha)	12	4,320																--
Others (protection of seeds and harvest)	--		--	200		200		200		200		200		200		200		200
Total cost/ha		10,550 or 9,870		6,985		1,435		2,575		2,575		7,800		6,200		675		4,000

* Excluding renting cost of sprayer

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costs 360 CFA on credit and 340 cash. The sprayer is rented from the AVV for 500 CFA a year for endrine or 730 CFA plus at least 460 CFA for the necessary batteries for nuvacron. When there are many insects, the farmer may have to apply more than four treatments. Cowpeas can also receive insecticides, but this is not required.

For all crops, one thinning and at least one weeding followed by ridging should be done within one month of the sowing date. The seeds and the harvested crops must be protected with thioral and actelic, respectively. This costs about 200 CFA a year for the production of one hectare.

When a crop fails totally because of natural causes such as flooding, damage from animals, or because of a technical error on the part of the AVV, an insurance program covers the cost of all inputs used by the farmer on that field, if they are bought on credit at the AVV.

Table 10 shows the quantity of inputs recommended per hectare for each crop and gives the cost on credit (nearly all farmers buy on credit).

2.3 Small equipment

The AVV destumps one of the bush fields and plows both fields with heavy equipment for all first-year settlers, the farmers themselves using only hand tools for the remaining operations. The AVV gives each family the basic tools (one hatchet, one pick-axe, one shovel, one machete, one file, and one seeding rope) upon arrival. Other needed tools (one large and one small hoe for each worker, perhaps an extra machete) are bought by the farmer, who must also pay for needed repairs and for new tools (including replacements) needed in the future.

The estimated cost of the small tools is 1,200 CFA a year (not including rental of the sprayer) for each standard unit of labor (see Table 11), for an average family with five workers (most representative of the sample studied).

2.4 Animal traction

At the beginning of his second year at the AVV, the farmer is given the opportunity to buy a pair of oxen and needed equipment (yoke, plow, triangle and ridger) with a seven-year loan.

The amount of the loan has greatly increased since 1974, mostly because of an increase in the price of oxen. The AVV plans for the oxen to be sold in the fourth year, and in that year the installment due the Credit Unit is very high for oxen bought in or after 1977. The yearly payment depends, therefore, upon the year in which the oxen were bought. If they are sold later than the fourth year, part of that installment can be delayed (see Table 12).

Before receiving his oxen, the farmer must pay an insurance fee which covers loss from all causes of death except negligence on the part of the farmer, during four years. This cost 3000 CFA until 1978, 4000

TABLE 11. Cost of Small Tools to be Purchased Yearly by the Settler for a Family of Five Workers (in CFA)
(equals 3.6 standard units of labor)

Tools	Number	Unit Price (CFA)	Total Cost (CFA)	Useful Life (Years)	Yearly Cost at Local Market (CFA)
Hoe	5	210	1050	1	1050
Daba	5	190	950	0,5	1900
Machete*	2	340	680	1	680
Hatchet*	1	240	240	1	240
Pick-axe*	1	110	110	1	110
Shovel*	1	500	500	2	250
Seeding Cord*	1	120	120	1	120
TOTAL					4350

*Tools which can also be bought at the AVV store.

CFA afterwards per pair of oxen. In addition to his yearly payments, the farmer must also pay for needed veterinary care and food for the oxen, and upkeep and repair for the equipment.

There is a veterinary assistant in each cluster of villages who provided immunization and deworming at a cost of 500 CFA a year per ox in 1978, 1350 CFA in 1979. Other animals can also be treated by the veterinary assistant as needed, the farmer paying for the drugs used.

The cost of feeding the oxen and repairing the equipment is only partly balanced by the increase in value of the oxen because of weight gain. If the oxen are correctly fed they can gain around 200 kilos in the four years of utilization. A detailed list of the different costs is shown in Table 13.

TABLE 12

Annual Installment for the Purchase on Credit of a
Pair of Oxen and the Standard Equipment, in CFA

Year of Purchase	Insurance	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Total
1974	3,000	10.000	15.000	8.970	8.970	8.970	8.970	8.970	72.850
1975	3,000	7.500	11.000	16.800	16.800	16.800	16.800	16.800	105.500
1976	3,000	7.500	11.000	18.600	18.600	18.600	18.600	18.600	114.500
1977	3,000	7.500	11.000	16.000	38.595	20.000	20.000	20.000	136.095
1978	4,000	7.500	11.000	16.000	34.935	20.000	20.000	20.000	133.435
1979	4,000	8.500	11.500	16.000	36.051	21.000	21.000	21.000	139.051

TABLE 13. Yearly Cost of Ox Traction in CFA for One Pair of Oxen and Their Equipment (Purchased in 1978 and 1979)

Oxen	Oxen purchased	
	1978	1979
	CFA	
A. Minerals: ¹ 30 kg at 130 CFA	3,900	3,900
B. Cotton seed ¹ (March-June) 480 kg at 4 CFA	1,920	1,920
C. Ropes ¹	2,400	2,400
D. Veterinary Care	1,000	2,700
E. Insurance	<u>750</u>	<u>1,000</u>
Total	9,970	11,920
Equipment ¹		
F. Amortization ² of the plow (10 years)	1,930	1,930
G. Maintenance ³	1,930	1,930
H. Amortization ² of the triangle (5 years)	2,350	2,340
I. Maintenance ³	1,170	1,170
J. Amortization ² of the ridger (8 years)	690	690
K. Maintenance ³	550	550
L. Amortization ² of the yoke (plow) (5 years)	<u>600</u>	<u>700</u>
Total	9,220	9,310

Interest costs of the agricultural credit average 7% for a loan. In practice most of the farmers finance the purchase and running expenses of the ox traction on credit. Short term credit can be used for maintenance cost of the equipment and the extra food for the animals. The insurance of the oxen has to be paid cash, so this element has no interest component nor does the veterinary fees (which only partly cover the real costs). A yoke for weeding can be bought from the village smith and paid for in cash.

The average yearly interest costs are shown in Table 14. They were calculated as if repayment of the loan stretched over the useful life of the equipment.

The total yearly costs of ox-traction to the farmer increased from 25,605 CFA in 1978 to 28,010 CFA in 1979 (9%) and represent a considerable investment for the farmer. The real cost to the farmer is even higher because repayment must be completed before the equipment is completely amortized. The low repayments in the first few years imply a higher interest cost, which has to be earned during the same period.

¹Bought on credit

²A linear amortization is assumed, with a remaining value of zero.

³Maintenance is estimated at 10% of the purchase price per year.

After the first four years of work the oxen can be sold for a very high price, which compensates for a part of the high cost of animal traction (see Table 15), but this price can only be reached if they have been well fed.

TABLE 14. Interest Costs of the Animal Traction if Bought on Credit at AVV for the Years of Purchase 1978 and 1979

Oxen purchased in	Average Value of Investment		Amount of Interest 7% (CFA)	
	1978	1979	1978	1979
Oxen:				
Purchase price	60,000	65,000	4,200	4,550
Upkeep (A+B+C in Table 13)	8,220	8,220	575	575
Equipment:				
Average investment ¹	19,780	20,000	1,385	1,400
Maintenance (G+I+K in Table 13)	3,650	3,650	<u>255</u>	<u>255</u>
Total			6,415	6,780

An increase in production can be expected from the use of ox traction either through an increase in production per hectare or an increase in total area cultivated. Both hypotheses will be tested in Part IV.

TABLE 15. Estimated Total Costs of Animal Traction in CFA

		Oxen purchased in	
		1978	1979
Purchase price of pair of oxen (2/3 years old)	(CFA)	60,000	65,000
Total costs of using oxen and equipment for four years	(CFA)	102,420	112,040
Selling price of pair of oxen (6/7 years old)	(CFA)	124,000	134,300
Result after four years	(CFA)	38,420	42,740
Yearly cotton production needed to cover the cost of ox traction	(kg)	175	195

¹The average investment equals 50 percent of the purchase price with a linear amortization.

After a few years of experience with ox traction, the AVV farmer can also buy a cart, which can be purchased for 53,500 CFA cash, or if the farmer is up to date in his other payments, on credit (see Table 16).

TABLE 16. Repayment for a Cart Bought on Credit (price 1979)
(Source: AVV Credit Agricole)

Date of Repayment	CFA
Down payment	15,000
Payment year 1	14,670.49
Payment year 2	14,670.49
Payment year 3	<u>14,670.49</u>
Total	59,011.47

3. Agricultural Production

3.1 Estimated yields

The AVV assumes that a farmer using the recommended levels of inputs and crop care can achieve the following yields under normal weather conditions (see Table 17).

TABLE 17. Expected Yields for AVV Farms, kg/ha
(Source: AVV Extension Service)

Cotton	800 - 1,000
White Sorghum	900 - 1,000
Red Sorghum	about 1,000
Maize	800 - 1,200
Cowpeas	500 - 700
Rice	1,000 - 1,500
Peanuts	900 - 1,000
Millet	about 600
Soybeans	800 - 1,200

3.2 Marketing

Most of the cotton harvest is sold to SOFITEX, which has a monopoly on the marketing of cotton. The AVV and SOFITEX set up a calendar for market days in each AVV village after the harvest. The AVV agents evaluate the quality of the harvested cotton, weigh the crop of each farmer and SOFITEX pays him on the spot. SOFITEX ensures the transportation of the harvest to the factory. The exact quantity sold by each family is known, but this is not equal to the total production of the family since part of the harvest is used in payment for help during harvesting and also to fulfill various social obligations, some is often spun and woven at home, and some is sometimes sold on the local market. Since 1978, the price is 55 CFA per kg for first quality, 45 CFA per kg for second and third quality.

In 1978, the AVV offered to buy part of the sorghum and to store it in the AVV warehouse in the same cluster of villages. This stock can be

sold at cost (purchase price plus cost of storage) to those farmers who suffer a bad harvest in following years, or even given out to be reimbursed in kind after the next harvest. The AVV paid the official price fixed by the government (see Table 18).

TABLE 18. Official Prices in Upper Volta of the Most Important Agricultural Products (in CFA) in 1978-79

Type	Price in CFA Paid to the Producer	Price to the Consumer in CFA (max.)
White Sorghum	40	57
Red Sorghum	30	47
Maize	40	57
Cowpeas	45	65
Millet	40	57

3.3 Food Consumption

At the national level, the average intake per capita per day is estimated at 1,728 calories, including 55.9 grams of proteins of which 3.7 grams are from animal sources, an intake which is not sufficient to assure an adequate nutritional level (Frohbert).

The FAO estimates the minimum daily needs for East Africa to be 2,500 calories (including 65 grams of protein) for an active man, and 2,200 calories (including 60 grams of protein) for an adult woman. These requirements are higher than the standard 2,230 calories per person per day which had been used in the Report on Project Identification of the Dutch government (1975) for the AVV. It is this latter standard which is used here, as it seems more realistic. A daily requirement of 2,230 calories per day is equivalent to some 240 kg of cereals and 30 kg of legumes per person and per year, including losses during storage.

In the sample studied, in 1978 and 1979 each labor unit must provide enough food for 2.2 persons and must, therefore, produce 550 kg of cereals and 70 kg of legumes each year. The value of this production will be calculated in Part IV.

PART III
MONITORING OF A DEVELOPMENT PROJECT

1. The need for on-going monitoring

During the last few years, development agencies have emphasized the need for increasing food production by the small farmer and expanding the small farmer's participation in this effort (Agricultural Development Policy Paper, June 1978). This requires a better understanding of the small farmer's behavior and constraints in traditional farming, as well as of his attitude and adjustments when new farming techniques are made available to him.

During the implementation of an agricultural development project, the managers and technicians need to evaluate the results achieved at the farm level and to compare them with those forecast in the project paper, at a time when they can still adjust the technical package and extension approach as needed. Rural development projects must therefore include an on-going monitoring and evaluation system that links farmers' activities, extension services, and agronomic experimentation.

The data gathered as part of normal management of the project, such as number of people reached by the project, details on procurement and maintenance of necessary equipment and inputs, and credit awarded to farmers, are necessary to timely implementation of the project, but they are not conducive to an evaluation of the impact of the paper, nor do they help in refining design procedures for future projects. To perform these tasks, it is necessary to set up a monitoring system that registers how the technical package is presented to the farmer, how the farmer actually uses it, and what results are achieved. This data must be completed by information on off-farm activities and sources of income. Such knowledge, if shared by management, agronomic research, and extension services, makes it possible to:

- make adjustments in the technical package and extension efforts during implementation of the project and therefore develop and refine technical packages adapted to the local, natural and social environment.
- control the effectiveness of the project design and implementation, and better assess the impact of the project on the target population and its spread effect, thus providing the basis for more valid post-evaluation and cost benefit analysis of the project.
- design future projects more likely to stand up under the constraints of implementation.

A monitoring system is useful only if it provides the data needed for analysis which are not already available. For example, in the AVV, the technical package includes the use of chemical fertilizer. As part of routine management, the Agricultural Credit Unit keeps precise data on the quantity of a specific type of fertilizer delivered to each warehouse,

and on the quantity sold to individual farmers. However, it would be wrong to try to correlate the quantity bought by the farmer with the yield achieved, because experience has shown that some farmers sold or gave away part of the fertilizer they bought. To evaluate the effect of the fertilizer it is first necessary to know how much was put on what crop, how and when. Even this by itself would not be sufficient, as other farming activities and environmental factors influencing the yield should be taken into account.

A "farming system research" approach is well adapted to the needs of monitoring an agricultural project, because it makes a global evaluation of the farming unit possible in all its aspects; technical, economical and social. This provides a more efficient management tool for the project implementers, and also leads to more pertinent recommendations for the design and implementation of future projects.

Since there is as yet no consensus on the definition of the farming system research approach we will first define our use of that term. We will then describe the data it requires, and will discuss the stages in implementation of data gathering and analysis. A farming system research focuses on the family farm as a unit of production and as a social unit, so that all technical, economic and social constraints on the farming activities performed are perceived in a systematic manner and their inter-correlations are taken into account. The farmer participating in a development project must make regular decisions on whether he will follow the extension agent's instructions, or more often to what degree he will follow them.

It is this interplay between a static technical package and the behavioral flexibility of the farmer which must be brought to light in a good monitoring system. This can be understood only if the broad socio-economic environment of the farmer is studied, so data must be gathered in five broad categories:

- composition of the household and social ties and obligations towards other households. This identifies the availability of workers and also the number of people who must be fed from the farm production.

- agricultural production, including access to land, labor, inputs, and equipment used.

- non-agricultural activities performed by the family. Because of the time involved and possible income generated, data must be gathered on livestock, trade, crafts, paid labor and processing activities.

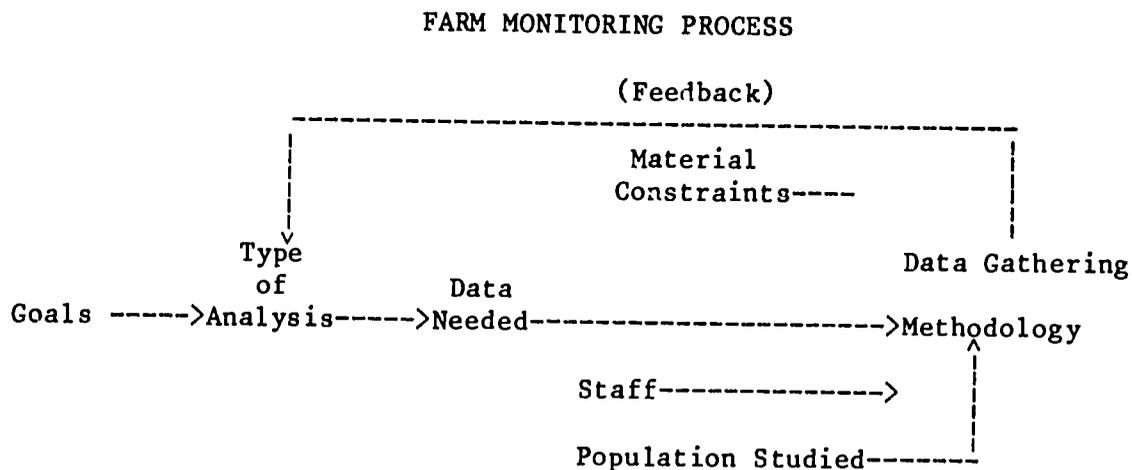
- family budget, to identify the financial needs of the family.

- regional economic information such as prices and absorption capacity of local markets, opportunities for employment, etc.

Natural and administrative constraints have probably already been ascertained during project design and would not usually be part of the regular data gathering in a monitoring system.

The rest of this chapter will discuss how to set up and use a monitoring system, drawing upon the experience acquired while working with the Volta Valley Authority. This work provides the AVV with a data base which will be useful for future evaluations; it also provides useful background information to researchers working in similar areas or on similar approaches to development.

Setting up and using a monitoring system is a process that evolves through several phases, but all the phases are interdependent, and feedback channels are integral parts of the system (see figure 1).



While the next section will discuss those phases one by one, it must be kept in mind that each takes its full sense when placed in context.

2. Data Gathering

2.1 Identification of goals

A farm monitoring system is first of all a management tool which must be adapted to the needs of the institution which requests it. The goals of the farm monitoring system must therefore be discussed with the administrators of the host institution, both for short term and long term planning. Once the goals are correctly identified, a literature search can be started to obtain basic information about the area to be studied and about similar studies in other regions. A lot of extra work can be avoided if the experience already acquired by others can be used from the beginning, even though much useful experience is published in reports which are often difficult to obtain.

2.2 Staff and Equipment Available

The level of education of both the enumerators and the farmers must be taken into consideration when organizing the data collection. It is therefore essential that both groups are involved as much as possible in the development process of the farm monitoring.

The local staff members who will carry out the farm surveys can be the main limitation on the gathering of good quality data, especially at the start of a project, as their level of education is often low and they

have little or no experience in data gathering. With adapted forms, simple, systematic and clearly written, and with detailed explanations of their work, the quality of the data can be assured if they are adequately supervised. It is however essential to limit the research to simple elements and units that they can understand.

The enumerators should be adequately equipped to work efficiently. This equipment however has to be adapted to the specific situation and to the kind of survey carried out. In general the equipment should be simple, very sturdy, of good quality and easy to transport (if needed).

2.3 The Population to be Studied

A good farm monitoring survey cannot be set up correctly if it is not adapted to the farmers to be studied. Knowledge of the existing farming systems and of the educational level of the farmers is important for the design of the farm monitoring. If the farmers use only local expressions for time, weight and measurements, then the survey should use the same. The researcher can later evaluate the relationship between the local measures and more international units of measurements. This can be quite difficult for there is a variation in time and space of many units of measurement. However adaptation of the survey to the local situation is one of the most important ways to obtain data of acceptable quality.

Basic information about the population can be obtained from informal talks with the local authorities, the farmers, and the extension agents. An existing systematic census can be used to obtain basic information from which the sample can be selected.

2.4 Defining Strategies

The goals developed by the agency will have to be translated into a list of items to be studied, and how they will be analyzed. A global preliminary program of data collection and analysis will be set up, taking into consideration the population, enumerators, and materials constraints. This program, which includes the type of data, time schedule, and format of the results of the farm monitoring, should be discussed with the agency, to assure that the goals of the agency are correctly interpreted. For the agency itself, it gives the opportunity to add some data or analysis requirements or to delete others if the proposed analysis cannot satisfy their needs at the proper time. When a consensus has been reached, the program can be designed in more detail.

It should be set up step-by-step so that adaptations can be made. The farmers and enumerators should be consulted and involved in the drafts of the program and questionnaires, as regular feedback will assure the optimal adaptability of the system at all levels.

2.5 First Draft of the Survey

The first draft of the questionnaires should be designed in close cooperation with the local staff. Their knowledge of the local situation, and especially that the impact of material constraints

(communications, equipment) will be important in designing a survey that can be implemented without too many difficulties.

When drafting a questionnaire, it is easiest to first list all the items which will be needed, then to regroup them by categories, so that separate inquiries can be constructed for each category. It is always easier to aggregate results later on than to subdivide them. It is important that the categories chosen be adapted to the population studied rather than to western standards, although definitions in western terms will also be needed for future comparison. The questionnaires should include some cross checks, so that some basic quality control can be done quickly. This is especially easy if the format chosen includes the most likely answers, so that the enumerator simply checks the correct answers. This type of format will also facilitate the tabulation and analysis of the data.

The set of questionnaires must be completed by systematic direct observation of the farmers' activities by the enumerators. This provides additional information and is also a means of checking the farmers' answers to the questionnaires. The work schedule of the enumerators must be planned in detail, taking into account their location and means of transportation, so that they know precisely day by day what they have to do.

2.6 Testing the Survey

Ideally, the surveys should then be tested on a special sample, similar to that to be studied, the test surveys being introduced and executed exactly as planned for the final surveys. This is the best way to develop a system that will work in the specific circumstances of the study, for two reasons:

- the methodology is tested and possible shortcomings can be eliminated. The testing procedure also provides more information about the enumerators and the population to be studied, so that the final inquiry can be better adapted to their ability.
- the quantitative results obtained will show the relevance of each question and make it possible to design the tabulation forms for future analysis. They should be checked with the local field staff.

The results of the test questionnaires are not to be treated as valid quantitative data. There are too many possible errors due to such problems as faulty design of the questionnaires and introduction errors. The results however can be used to try a hand tabulation format (see annex II). That way it is possible to discover whether questionnaires and tabulation forms are well adapted to each other. In case of difficulties in transferring the data into tabulated form, both the questionnaires and the recapitulative tables used for tabulation can be redesigned.

Even with inaccurate data the pre-test provides much useful information about the population, especially if those who designed the inquiry participate in the testing of the questionnaires. The results obtained can be presented to the agency in order to show what they can expect in reality from the farm survey. This feedback can provide useful suggestions for further development of the questionnaire tabulations.

2.7 Choice of the Sample

The absolute size of the sample is limited both by the number of enumerators and the work program. During the development phase of the program the possible sample size was already taken into account; in this phase sample size determination is a back and forth process between the complexity of the inquiry and the possible sample size for a given number of enumerators. Yet a minimum size is required to extrapolate the results from a sample, so it may be necessary to simplify the questionnaires in order for the enumerators to handle an adequate sample.

The choice of the sample derives from the goals of the study, since they determine the subgroups to be studied. For example, the year of arrival of a family in a settlement scheme was considered crucial in the AVV study. Once the stratification is chosen, the sample can be selected at random, or, if there is sufficient information about the population, a more systematic sampling method can be used to ensure that all groups are well represented. This system however has the risk of a misrepresentation because it is difficult to include all segments of the population.

2.8 Setting up the Survey

The definitive program for the monitoring system is established after discussing the results from the testing period. The main elements of the program, including the questionnaires, must then remain unchanged for at least one production cycle, although small adaptations can still be made. Any data gathering process should be flexible enough to react adequately to specific unexpected changes in the population to be studied or in the identified goals. After the first agricultural cycle the whole program has to be reviewed again to see whether it still meets the possibly changed goals and to incorporate the already acquired experience.

The entire farm survey program thus developed must be explained to the enumerators. All aspects of the job, including the goals of the study, must be discussed together until it is sure that each enumerator has completely understood. Each enumerator should receive a handbook describing his job step-by-step, that he can use as a reference, and which also provides solutions to the problems he is most likely to meet during his survey work. He is already familiar with most of the elements of the survey since he has participated in its development.

When the enumerator has completely understood the purpose and details of his work the inquiry can then be introduced to the farmers. This introduction is very important and greatly influences the quality of the data. In a continuous farm survey, where the same group of farmers are closely followed and are interviewed regularly, a careful

introduction is required to assure their cooperation. In a strongly hierarchical society, the first contact should be made with the chief of the village before the survey begins. The chief and his associates should be well informed about the goals, programs and users of the survey, since the work cannot begin without the chief's approval, and since he can be very informative about the village. The proper backing can be very useful during the introduction and implementation of the survey at the farm level.

With the help of the chief (or his representatives) a meeting can be called of the farmers in the sample, or the farmers can be approached individually. A meeting with a group of farmers has the advantage that they are less overwhelmed by the foreign visitors; that can result in more questions and remarks, which are useful for the inquiry itself and the interpretation of the results. However, in practice it can be difficult to organize such a meeting.

At the first contact the farm survey is introduced and its goals explained. The details of the explanation depend very much on the level of education of the farmers and should be kept clear and simple. If possible the enumerator who will work there should do the explanation. He often has more feeling for the farmers and is better able to adapt his explanation to their need, if the survey has been well discussed with him beforehand. This approach also shows how the enumerator himself understands the survey and how he responds to questions from the farmers.

After the goals of the survey have been explained, the farmers should be assured that the data will not be used against them (for taxes, by the agricultural credit department, etc.) and they should be told how they were chosen for the sample. The program of work of the interviewers is explained in detail, every aspect has to be explained, stating how it will be done and why.

After these explanations, the farmers should be encouraged to ask questions about all aspects of the surveys. This often results in requests for copies of parts of data, especially harvest data. Finally every farmer should be asked if he agrees to cooperate with the survey, as it will happen that a farmer refuses, especially at the beginning of the survey work in the area.

2.9 Quality Control

In addition to the regular cross checks within the inquiry and the program of work itself, there are several ways of assuring the quality of the data. At the start of a farm survey, the enumerators will often meet problems which were not foreseen during the planning and testing phase. An intensive program of regular technical assistance to the enumerators can identify and solve many problems on the spot and avoid future problems. This program should be backed by written explanation of the survey and its goals, giving details on the purpose of each inquiry and showing how to fill out the form and the daily program to be done. Those explanations are compiled in a handbook in which most of the problems that arise are treated, and the enumerator should be taught how to use his handbook to solve a problem. If it becomes clear during the season that

the handbook is not complete, additions should be made. This can be the case if an extra survey is begun later on. The handbook, together with regular field visits of the technicians to assist the enumerator in his work, assures a systematic improvement of his ability to do his job correctly.

Besides this on-the-job training, more formal training sessions can contribute much to increasing the specific skills of the enumerators and, not less important, to strengthening their motivation. The enumerators meet together, for example once a month, so one subject related to their job can be discussed in more detail than is possible during the visits to individual enumerators. That way it is possible to make the enumerators understand more about the theoretical background of their work. It is very important for them to learn that their work is more than just gathering numbers. They can be kept interested for a longer time only by showing them what happens with their data afterwards and what is the relevance of the analysis for the agency they work for. At the end of the session, the problems recently encountered can be discussed, the enumerators informing each other of their work problems, and of the solutions they provided. This gives a better insight into the functioning of the data gathering.

An important test of quality is a good relationship with the farmers. The first effort in building a good relationship with the farmer is done when the survey is introduced to him. During the survey, the farmer should be involved in the process as much as possible, and should be told of the results. Remarks from his part should be taken into account as much as possible in redesigning the questionnaires and in interpreting the results.

3. Compiling and preparing the data for analysis

The data gathered in the field are sent regularly from the field to the main office to be compiled and analysed. Before the analysis can start the data will be checked for their completeness and quality. The quality of an on-going farm survey, especially one which includes a rather detailed labor time survey, is lower if information is missing for some of the working days of a family. It would be unrealistic to limit the analysis to those inquiries which are complete, as most of the data gathered would be unusable. At AVV, 24 days each month (80%) had to be monitored correctly before the data on any family was included in the tabulation and analysis. Depending on the quality demands a limit should be set to identify when an inquiry is considered complete enough to be used. In the beginning of a survey data may be included which do not meet the requirement in order to show the potential users what kind of data and in what format they can expect it, and thus give them the possibility to respond.

The data which passed the check for completeness are controlled to see whether the quality of the data is acceptable. This includes checking that each individual questionnaire is completely filled out and looking for inconsistencies between data. If some of the data of a subsection of the survey are doubtful, that whole subsection can be rejected. For a continuous survey, this can lead to the rejection of that

subsection from the survey for the whole period, because the total of complete good quality inquiries concerning that subsection does not meet the standards. Sometimes it is possible to return to the enumerator with the form and discuss the problem together so that a solution can be found and the correct data can be entered.

The standards for the quality check depend very much on the quality of the enumerators. The enumerators at AVV had little professional experience and no training, so at first the standards for data acceptability could not be very high. After an intensive training program had started, however, standards could be raised rapidly.

In defining the quantity and quality requirements of a survey there is always a conflict between the desire for perfect quality data and what is really possible because of limited human resources. It is often better to have more global data of a lower quality than only a few detailed cases of high quality. In countries like Upper Volta, variations within the population to be studied are often so great that a large sample of observations is necessary before conclusions can be drawn. Every project involved in data gathering has to establish its own minimum standards for the data. This should be a decision carefully thought out, as it influences quality checks to be included and also the necessary on the job training for the enumerator.

During the development of the survey most of the basic tabulation models have already been set up in broad lines in order to get an easy transfer of the data. The main sub-groups to be considered in the analysis have been identified when the goals of the agency were defined. This grouping has been refined during discussions with the different departments until a final framework is agreed upon. The relevant subgroups and the entire population are tabulated so that comparisons between the groups can be made. The results of those tabulations, which include nothing more complicated than averages and variances, are used for two important goals.

- The results of the tabulations can give an extra check on the data. It should correspond with the knowledge about the sample and population, or the differences will have to be explained. The difference between the groups considered (or the lack of difference) shows whether the grouping is a relevant one or not. If not, some groups can be lumped together in the future, making the analysis less complex. Examining the results can also give an indication that other groupings will have to be considered. This will be a feedback to the inquiry itself and so the form can be adapted if needed and if possible.

- The results of the tabulation can be presented in a regular report to the users of the data. At AVV an effort was made to establish a quarterly report but, for administrative reasons, the delay in typing the report was so great that the information provided was no longer useful. Nevertheless, it gave information about the data gathered and the methodology applied. Reactions given by the future users and suggestions concerning format and data choices were carefully considered and included in the development of the forms and program.

The way in which the results are presented gives an indication of the quality of the results. Presentation of precise figures implies that the calculations were done with very precise data to start with. In order to avoid misinterpretations and misuse of the data presented, the presentation format should be adapted to the reliability of the data. This implies a careful choice of the classes in which the data will be presented and a correct rounding procedure. At AVV, crop yields are presented in units of 10kg because the method used to estimate the yields is not accurate enough to present more precise figures (see IV).

4. Analyzing the data

Recent developments in hand calculators have made hand analysis very easy if the body of data is not too large, since standard programs for analyses of variance and covariance and for curve fitting are available for most models.

If the questionnaires and especially the recapitulative forms are designed with specific calculations in mind, so that all the data needed for one specific analysis are on the same side of a page, hand calculation is probably the fastest way to get results at the beginning of the project. However, in a long term project, hand analysis can become difficult. In that case it is recommended to switch to computer analysis early during the project, so that there is time to set up the keypunching routine and to debug the necessary programs before there is too much pressure to obtain results. Once the routines are satisfactory, it becomes easy to add new data to the data base in the same format. Two solutions are now possible: to do the entire analysis on a micro-computer within the project itself, or to have the computer work done at a regular computer center in the host country or at home.

4.1. Using a Micro-Computer in the Field

Micro-computers are now available which are cheap and easy to transport. They offer interesting possibilities for data analysis in the field during the implementation phase of the project, when it is still possible to modify or expand the questionnaires in response to the preliminary results. In order for the micro-computer to be used regularly, it is necessary to have access to an efficient material and technical backstopping, as problems are bound to arise both with the equipment itself and with the programs.

The equipment has a better chance to remain usable if it is set up in an adequate environment, with daily sweeping and dusting, and keeping the equipment covered with plastic when not in use. The micro-computer can be run on electric power, but a voltage regulator must be used at all times for the equipment is rather sensitive to fluctuation in voltage. The advantage of using batteries is that the work can continue during power failures.

It is crucial to find keypunchers who can be fully trusted, since it will not be possible to check the accuracy of their work all the time. The keypuncher must be honest enough to enter the data accurately and to check the quality of his work himself. In a job which is rather tedious

and boring, this can be achieved only if the keypuncher has some interest in the outcome of the study, and if he understands the importance of his work.

In Upper Volta, experience has shown that someone with no technical knowledge or experience in computers can be trained to keypunch in a few days. Basic requirements in hiring a keypuncher should be:

- the ability to continue detailed and precise work over a period of time. This can be ascertained through test exercises.
- the ability to read the language in which the questionnaires are written, if they are not fully coded.
- familiarity with the research subject. In keypunching the AVV data, the keypuncher who was more familiar with agriculture was better able to control the quality of the data and to keypunch it accurately.
- the moral honesty of doing a thorough and accurate job on his own. It is difficult to foresee this when hiring someone, but it should be made very clear that errors must be corrected, and that sloppy work will not be tolerated.
- some familiarity with typing can help at first, but with the new keyboards with an additional set of digit keys on the side this is not necessary.

In Upper Volta, the keypunchers were selected after a written test, an interview, and a test with the micro-computer to see how they handled the machine and how fast they learned to perform very simple tasks. A special program "learning to use the micro-computer" was used, the candidate following the instructions he read on the screen.

The keypunchers read documents explaining the goal of the project, and also the Handbook for Enumerators, in which every questionnaire was described and they received detailed explanations about the surveys they had to keypunch. They were then shown how to start the machine and keypunch one questionnaire, and were given oral and written instructions on what to do in case of difficulty. They practiced for a few days, until a thorough check of their work showed good accuracy.

Each keypuncher always had a precise program of work including one set of questionnaires to keypunch, and also some hand tabulation which he could do whenever he tired of keypunching. It was emphasized that it was better to take a break when the work seemed too tedious rather than keypunching errors.

Ideally, the entire process, from data gathering to analysis, should be done directly under the supervision of the researcher in the field. The micro-computer gives its full value only if it enables the researcher to analyze partial data during the implementation of the project, so that the questionnaires can be modified as needed and eventually new questions

can be added to confirm or explain the first results. In order to do this, the time span from data gathering to analysis must be as short as possible, while the quality of the work must be assured by checking the data and keeping the number of transfers to a minimum.

In Upper Volta, the data was keypunched directly for some questionnaires, while for others it was first transferred to recapitulative forms from which it was then keypunched. The data on livestock, non agricultural activities, and petty trade was keypunched directly from the questionnaire (see annex II), even though entries were not pre-coded. This was possible because the form was simple, and there were few possibilities for each variable. The keypuncher had a codebook for the variables in front of him and quickly learned to code what he was reading while keypunching it.

Because the questionnaire itself was not coded, it was also easy to check the quality of the data during visits to the enumerator or when the questionnaires were brought to Ouaga. It had been decided early in the project that the enumerators could not handle coding at that stage of their training, except in a very few instances (to indicate the sex of a worker, or whether a task was done manually or with animal traction). In these cases, the first letter of the word was always used as the code. The questionnaire already contained columns for most of the possible answers, and the enumerator only had to put a check in the proper column. It would have been helpful to also include the code at the top of the column, but anyway it was easy for the keypuncher to use the proper code because the numeric codes were chosen to match the order of the column whenever practical. Each questionnaire covered the activities of one family for one month, and was brought back to Ouaga at the end of the month to be keypunched immediately.

The data was keypunched onto cassettes, because of recurring technical difficulties in using floppy disks, which would have been faster. By using cassettes or disks as permanent files for each specific questionnaire, updating the file each month as the data comes in, it is possible to run simple statistics (frequencies, data formatting and description) each month on the updated data to see what trends might be developing, and to try different ways of regrouping the data. If the equipment is set up right at the beginning of the project, partial analysis can be available when it is still possible to modify the questionnaires, for example including a new variable, or subdividing a question. Other programs available include field area measurements and multiple regression and analysis of variance. In any case, after the data are coded and keypunched, basic frequency runs should be done in order to check if the data are entered correctly.

For many projects, the micro-computer provides more than sufficient capacity to handle all useful analysis, and makes it possible for the researcher himself to handle the analysis with little or no extra help. This is important, as only the researcher can decide how it makes sense to group the variables and which correlations are meaningful. Only if the analysis desired exceeds the capacity of a micro-computer should it be necessary to use a standard computer.

4.2 Using a standard computer

Computer techniques of today make it possible to analyze a great quantity of data in a very short time period. Standard programming methods are easy to use and make many kinds of analysis available for inexperienced users, so it is important to keypunch the data in such a way that standard programming methods can be applied and provide the requested results. The programmer who works with the data should be well informed of the analysis to be done, and should ideally check the tabulation files for ease in keypunching.

Most standard programs offer a wide range of analytical possibilities, but to avoid misinterpretation the analysis must be limited to those calculations which are in accordance with data quality, quantity and theoretical expectations. The analytical procedure should be built in such a way that only necessary calculations are done, starting from simple straightforward tabulations to more complex analyses. At every phase in this procedure one must reconsider whether more complex procedures will result in better explanation of the data or not.

Most data obtained by farm monitoring surveys as described in the first part of this section do not justify estimation of production functions or similar complex analyses. Those statistical packages require a larger, more precise body of data at the farm level than that which can be reasonably expected in most surveys in West African countries. They also require the isolation of a limited number of variables, which is difficult to do out of the complexity of a farming system because of the great heterogeneity of the farmer population. Most variables cannot be fixed or controlled as would be possible in experimental field circumstances.

However, the analyses which are compatible with the quality of the data offer sufficient possibilities to show differences between groups or classes of a population. Regression can be used but should be interpreted carefully, taking the quality and quantity of the body of data into account.

5. The AVV Data Gathering Program

The design of the AVV farm monitoring system began in 1977. At that time the agency itself did not have very specific ideas about the kind of data it expected from that survey, except that it should cover:

- characteristics of the AVV population
- agricultural labor inputs
- agricultural production.

Administrators and technical assistants in every AVV division were asked to suggest what additional data would be useful to them. It was agreed that data on agricultural inputs, livestock, off-farm activities and prices on local markets would be gathered so that an evaluation of the impact of the AVV program at the farm level could be made.

5.1 AVV Population Survey

In 1977 a very intensive population census was conducted among all AVV farmers in order to create a permanent file on the AVV population with its main characteristics. Such a file would be used by the AVV when planning for schools, dispensaries and agricultural supplies for the settlers.

A draft of the census form was discussed with the AVV managers who would be using it and with the enumerators. The final form (see Annex II-1) had to be filled out completely during the first inquiry, and the information updated once a year. For the new settlers, a form is opened in July of their year of arrival.

During the inquiry the data were checked in three ways to ascertain accuracy:

- the enumerator had to see the persons which were listed as permanent residents of the AVV farm.
- the ages were checked with identification papers whenever possible. However, about 60% of the farmers have no documents.
- the enumerator or extension worker who lives in the village checked the data afterwards.

The results were presented in a report a few months afterwards.

5.2 Market Survey

Once every 12 days (every fourth market) each enumerator has monitored the prices of the most important agricultural products being sold at the local market in the neighborhood of his village. The market survey started in a few markets in November 1977 and was later expanded. It had to be introduced through the local hierarchy (village and market chiefs), so delays occurred in some villages.

The enumerator monitored the price of agricultural commodities in local units of measurement. He was given cash to buy some produce, which he weighed at home to evaluate the relation between kilogram and the local units of measurement.

5.3 Farm Level Surveys, 1978

A draft of the farm survey program was discussed with AVV technicians and with the field personnel, and a preliminary set of questionnaires covering the development of an AVV farm over the first years of settlement was drawn. The questionnaires were tested and modified from August 1977 to the end of that crop season, and the 1978 survey was then designed on the basis of that experience. It was used throughout the 1978 campaign without significant changes.

TABLE 19. Sample of AVV Farmers Used in Analyzing the Surveys of the 1978 Campaign, by Cluster and Year of Arrival

	1974	1975	1976	1977	1978	Total
Linoghin	--	10	2	--	--	12
Mogtedo	12	4	2	6	12	36
Bane	12	--	5	7	--	24
Kaibo Nord	--	--	6	12	6	24
Kaibo Sud	24	--	--	--	12	36
Total	48	14	15	25	30	132

Each of 16 enumerators monitored 12 farmers from the village he lived in (see table 19) in two ways:

- he asked a set of questions to the farmers twice a week in order to fill out the survey forms.

- he visited the farmers of the sample in their fields and observed their activities in order to check the data provided by the farmer.

The questionnaires* for 1978 were systematically designed to be simple and adapted to the knowledge of the farmers and enumerators, so only local units of measurement were used. This made the tabulation of results easier also. As far as possible all answers were already written on the form to make it easy to fill out correctly. Coding was excluded except for very simple abbreviations because the enumerators could not handle that correctly.

The labortime was the most difficult part of the survey. Neither the farmers nor the enumerators have watches so quarter-days were chosen as the unit of measurement, this seemed practical for both the farmer and the enumerator. To avoid too many errors, this part of the survey was repeated twice a week (see Annex II, questionnaires 2 and 3). The farmer is quite capable of remembering after three or four days who was working on which field and how long, especially as he becomes used to the survey. When a labor inquiry could not be done on time (absence of farmer or enumerator, illness, etc.) a recapitulative form was filled out (see Annex II, questionnaire 4). Here the quarter days were replaced by whole days because the experimental stage in 1977 showed that the farmer did not remember correctly the quarter days for every member of the family after a week or more.

The rest of the questionnaire was filled out only once a week because it was simpler than the labor time. Questions about the amount of money spent to purchase agricultural tools and income from off-farm activities, etc. did not create any difficulty. It was also much easier

* see Annex II

to get the information about a longer period than a week if an inquiry could not be done on time. Careful introduction and the avoidance of very personal questions helped in gaining the farmers' confidence and therefore obtaining data of good quality.

The enumerator also had to go into the fields every (working) day; he was to try and see all of his 12 farmers and write down in a notebook what kind of work they were doing, who was there, what the field looked like, etc. Those field trips made him more familiar with the farmer and helped build up a good relationship with him. They also enabled the enumerator to check the data on agricultural labor provided by the farmer during the regular interviews. Third and not less important, the notebook provided useful information about the development of the crops and eventually mentioned reasons for crop failure; this is essential for a correct interpretation of the data.

During those field trips, the enumerator also had to measure the fields of the farmers surveyed. Most of the AVV fields are rectangular so this job could be easily done with only a measuring tape. A supervisor from the Statistical Section helped the enumerators to measure odd shaped fields. Right after measuring the field, the enumerator made a drawing of the field (and its measurements) on the back of the harvest estimation forms (see Annex II-5). All the fields (including unofficial fields outside of AVV plots) of the farmer surveyed had to be measured.

The yields of each crop of the 12 farmers in the survey were monitored except for the production of the house garden. The garden bears a mixture of crops in small quantities and they are harvested according to the needs of the family, so the estimation of yields is extremely difficult and often impossible.

The cotton harvest was estimated on a sample of three lines per hectare, which had to be harvested and weighed separately, the other crops by counting the number of (uniform) baskets harvested. Three baskets were taken out at random and weighed. The third one was threshed and weighed again. The farmers were very cooperative in this procedure mainly because the results were communicated directly to them.

The work of the enumerator was carefully explained to him and also closely followed. This was an important quality control on the data, together with the crosschecks in the surveys and the field trips. At the beginning of the survey the enumerator received an instruction manual which explained once more the details of his work and of each questionnaire. Every two weeks, a supervisor from the Statistical Section came to discuss with him and followed him in his work. In this way certain aspects of his job could be explained in more detail and problems could be solved together. Once a month, a training session was held to discuss more theoretical problems.

A preliminary analysis was done as soon as the data came in each month. This made it possible to spot and to correct problems with the data gathering. The results were presented to the AVV in bi-monthly reports which could be used for short term planning. However, the bi-monthly reports had to be abandoned when the delay between completion of

the draft and actual distribution of the typed text reached two months. After that, efforts were focused on preparing a yearly report at the end of each crop season.

The analysis presented in the 1977 and 1978 yearly reports was done entirely by hand. A recapitulative form for each farm in the sample made it easy to regroup the data in different ways (Annex II). The 1978 labor data was too large to be analyzed by hand, so it was transferred into recapitulative forms (Annex II-7) and then keypunched on a micro-computer in Ouagadougou for analysis on a standard computer in the States. This delayed presentation of the results until the 1979 report.

5.4 Farm Level Survey, 1979

In 1979, the surveys started in 1977 were continued without much change except for the labor time survey, which was done in a more global manner, using days as the unit of measurement (see Annex II). This was a check on the data obtained in 1978, and greatly cut down the time needed to survey each family, since a weekly visit became sufficient.

The enumerators, who were by then better trained and more experienced in survey techniques, were able to work with 12 new farmers in a neighboring village in addition to the 12 farmers they surveyed in their own village (see table 20).

TABLE 20. Sample of AVV Farmers in the Farm Survey of 1979
Used for the Analysis of the 1979 Crop Season,
by Cluster and Year of Arrival

	1973	1974	1975	1976	1977	1978	1979	Total
Linoghin	5	6	12	--	1	24	--	48
Mogtedo Bombore	--	21	5	5	30	12	24	97
Bane	--	12	6	11	7	--	12	48
Kaibo Nord	--	--	6	12	24	6	--	48
Kaibo Sud	--	36	12	--	--	24	--	72
Total	5	75	41	28	62	66	36	313

The format of the questionnaires was simplified, (see Annex II-8), both to make it easier for the enumerator to work with a double sample, and to make it possible to keypunch the data on a micro-computer directly from the questionnaires, as they were sent to Ouagadougou at the end of each month.

The harvest data was handled differently, because the basic forms on which the activities and results for each field were recorded had to be kept by the enumerator until the harvest was finished. A recapitulative form was designed on which the data for one crop for every farmer in a village was regrouped (annex II-10).

The recapitulative form was brought by the supervisor during his visits to the enumerator, and they regularly updated it. This had several advantages. It involved the enumerator in the analytical process and made him more conscious of the importance of his work. It showed clearly which data was unusual compared to the rest of the village, at a time when it could be checked easily with the enumerator and the farmer. It made later tabulations and analyses easy. Finally, it was keypunched directly from that form with only minor coding.

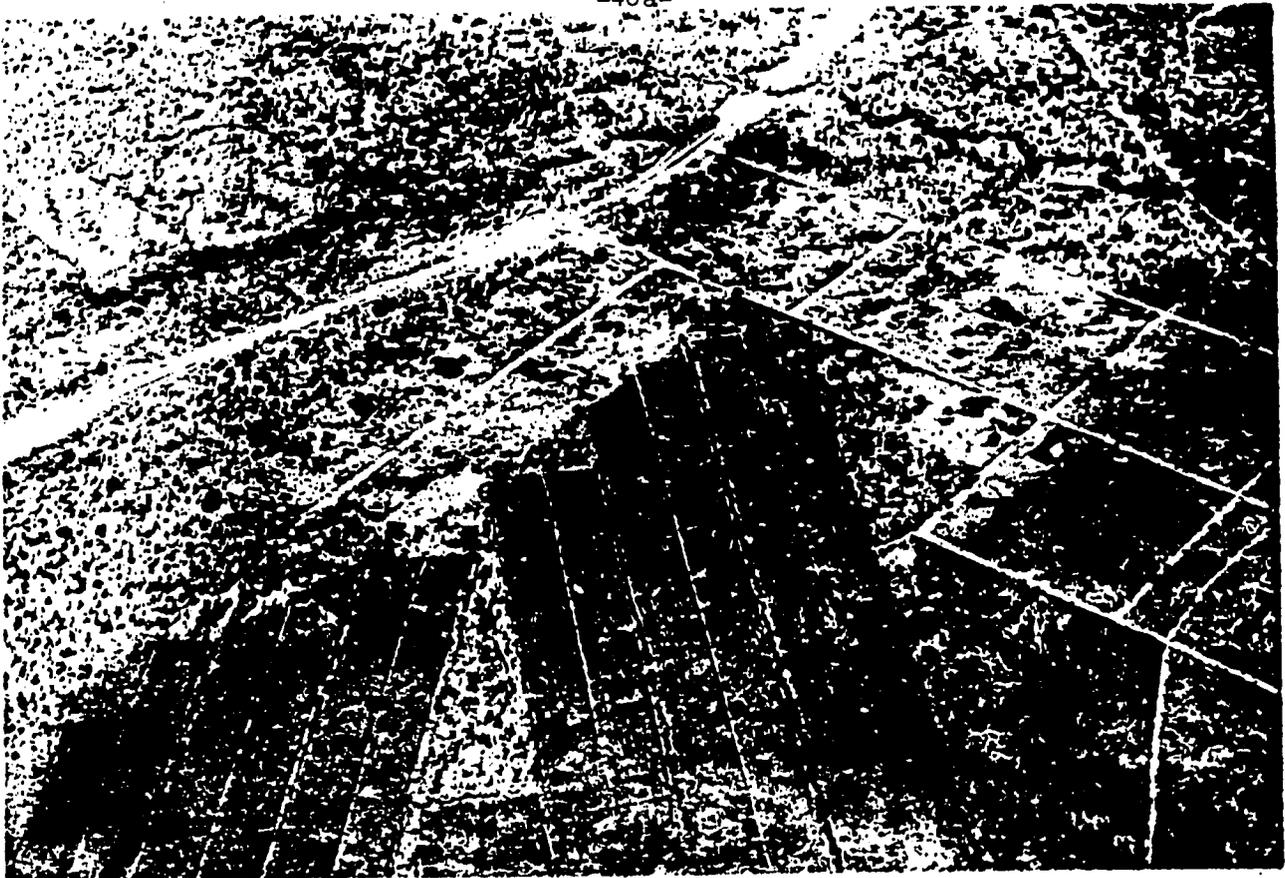
The data cassettes of all the surveys were transferred to a regular computer; the 1979 data have been analyzed partly by hand and partly by computer.

5.5 The 1980 Program

In 1980, the survey of agricultural activities is to be continued on the same sample, and more detailed surveys of livestock, craft and trade activities conducted on small samples of farmers who are particularly active in that type of work (see annex II-11,12,13).

The surveys performed from 1977 to 1979 have provided much information useful to AVV. Much experience has also been acquired on data gathering and analysis, and the staff of the Statistical Section has been trained. In the future, the AVV will have to reevaluate what it expects from farm monitoring. The Statistical Section cannot increase the size of the sample as the number of settlers increases and maintain the quality of the data it could assure until 1979, unless the number of enumerators increases also. This should not be expected at a time when the AVV is trying to reduce its costs.

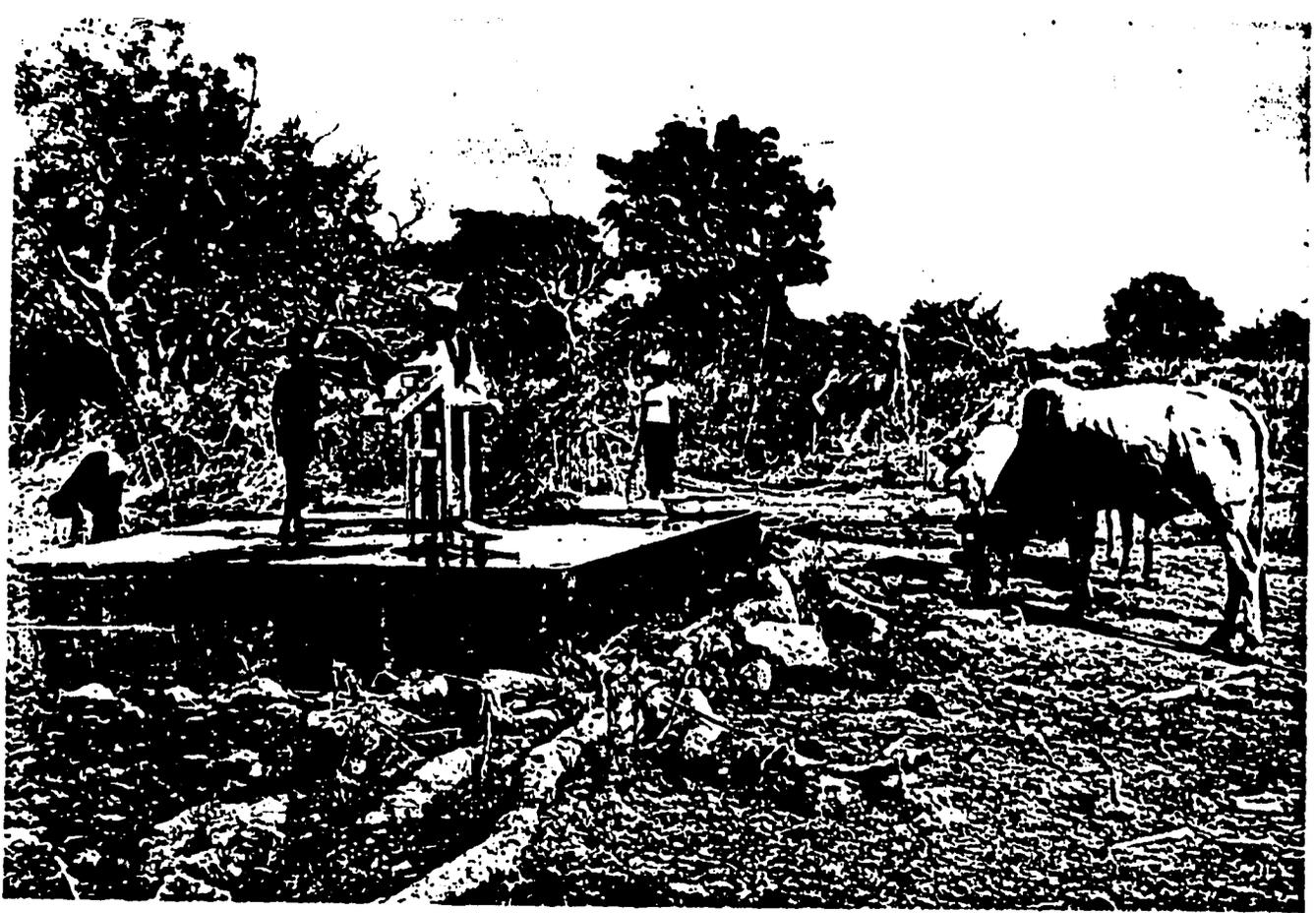
Most of the enumerator's time is now taken up with measuring the fields and estimating the harvest. Part of this work could be transferred to the extension agents in areas where AVV only needs global data for a regional evaluation. In that case the work of the enumerator can be reduced to those yield evaluations which are needed for input-output relations (e.g., for fertilizer response) in specific areas (see annex II-14). A small group of the best enumerators could be assigned to do farm surveys on large samples and to do detailed surveys of off-farm activities and other important aspects of the family enterprise such as family budgets on a smaller sample.



Picture 1: Layout of an AVV village (squares) and its fields (dark rectangles)



Picture 2: All new fields are mechanically prepared for cultivation by AVV



Picture 3: AVV drills one well for every 25 families



Picture 4: From the second year on, the farmer plows his fields with animal traction

PART IV

ECONOMIC RESULTS OF THE AVV FARM

1. Introduction

In this chapter the results are compiled of the farm monitoring at AVV during the period of 1977-1978. The part of the sample used for data analysis represented 11% of the AVV population in 1978 which was increased to 18% in 1979. About 50% of the farmers in the sample have been monitored from 1977 on.

The data gathered are presented per cluster of villages (assuming a certain homogeneity of rainfall (Annex I) and soil type within a cluster) and subdivided in four groups of farmers according to the stage of farm development.

1 New farmers who are settled this year by AVV. They have only two parcels* to cultivate, both plowed by AVV.

2 Second year farmers who have only three parcels* to cultivate of which one is plowed by AVV.

3 Farmers in development who have four parcels* to cultivate but one is plowed by AVV.

4 Established farmers. They have four parcels* to cultivate, and no plowing is provided by AVV anymore.

The three campaigns monitored (1977-1979) provide enough data to evaluate the net effect of the AVV's main innovations:

- does the fertilizer level prescribed by AVV have a positive effect on the crop yields?

- is animal traction (oxen) an innovation which permits the farmer to cultivate more land or achieve higher yields?

- does intensive farming pay off for the AVV farmer?

The data considered, however, are farm survey data. They are only reliable for a situation which deals with farmers of this level of technology. In situations of a higher level of management of the farmer, it is possible to get a different response to the proposed innovations.

2. Acreage and crop rotation

The area allotted by the AVV to each settler family is determined every year according to the year of arrival of the settler at the AVV and his family's labor index (see II-1). The index is updated every year at the beginning of the agricultural season, but even so the index does not always correspond to the reality because there are members joining the * excluding the house compound.

family during the crop season. The family has therefore often more workers than the labor-index shows. This is shown clearly by the yearly updating of the AVV population census in July (see III). The farmers react to this situation by cultivating about 10% more land than they are supposed to for their type. However, the total area cultivated by unit of labor remains within the limits defined in the AVV man/land ratio* (see table 21).** Differences in total amount of land cultivated for farmers who are at the same stage of development but in different clusters of villages are mainly due to the land distribution policy of the extension worker, the rainfall (which determines when the farmer can start sowing), and the area grown with cotton.

The cotton crop is the most promoted in the AVV package. Table 21 shows that the AVV farmers grow about the area they are supposed to grow with cash crops (5% more area is cultivated with cotton than is prescribed by AVV). It is an important crop for the farmer because he needs the cash to pay his credits, but it is a very labor-intensive crop (especially at harvest) and therefore the AVV farmers show a tendency to grow less cotton the longer they are at AVV.

White sorghum, the most important staple crop, is cultivated more than prescribed by AVV in the developing phase and when the farm has reached its full size. About 16% more land is cultivated with white sorghum than prescribed by AVV.

As addition to the white sorghum, the other cereals have priority over the legume crops. Until now the farmers' food supply has not yet been assured so most of the land has to be allotted to cereals. Farmers cultivate about 42% more corn and red sorghum than they are supposed to.

The legume crops therefore are strongly underrepresented. Only about 65% of the area planned for cowpeas and peanuts was really cultivated with those crops, in spite of their importance in the crop rotation.

The rotation prescribed by the AVV includes a two-year fallow period after each four years of cultivation, but many fields are now in their fifth and sixth years of continuous cultivation. The rotation also includes a legume crop in year three. However, 56% of the fields cultivated for more than two years have never been cultivated with legumes; for the fields cultivated for more than three years, this percentage declines to 24%. With a faulty crop rotation and insufficient levels of fertilizers, yields can be expected to decline over the years to the level of those of traditional farmers.

3. Inputs

The AVV farmer uses mostly the AVV seed varieties. For the white sorghum, only 7% of the official fields were sown with a local variety. In the Koulipele about 83% of the plots were sown with the variety recommended the previous years (Ouedzoure and S29). In the rest of the AVV clusters the recommended variety did not change and therefore most farmers cultivated it in 1979.

* Excluding the house compound.

** For 1978 data see Annex III-1.

TABLE 21. Area Cultivated per Unit of Labor in 1979 per Crop as % of Total Area Cultivated per Cluster of Villages and Stage of Farm Development (Exclusive of House Compound)

Cluster	Stage Farm Development	Area Cultivated Per unit of Labor	Importance of crop (in % of Total)						
			Cotton	Sorghum White	Sorghum Red	Corn	Cowpeas	Peanuts	Other
Linoghin	Second Year*	1.13	52	43	--	--	4	1	--
	Second Year	.93	46	49	--	--	4	1	--
	Developing	1.65	39	41	11	1	2	1	5
	Full Farm	1.77	30	33	7	5	7	2	16
Moytido Bombore	First Year*	.75	48	52	--	--	--	--	--
	Second Year*	1.24	50	45	--	--	3	2	--
	Second Year	.81	51	43	--	--	4	2	--
	Developing	1.09	44	48	--	3	3	2	--
	Full Farm	1.15	42	54	--	2	2	--	--
Bane	First Year*	.91	56	44	--	--	--	--	--
	Developing	1.56	28	38	30	--	3	--	--
	Full Farm	1.58	37	44	19	--	--	--	1
Kaibo Nord	Second Year	.98	40	45	12	--	3	--	--
	Developing	1.56	37	44	12	3	4	--	--
Kaibo Sud	Second Year	.83	41	41	5	6	7	--	--
	Developing	1.41	28	29	18	21	4	--	--
	Full Farm	1.43	31	43	8	13	4	--	1
AVV Program Nord	First Year*	.48-1.00	43-50	50-57	--	--	--	--	--
	Second Year	.65-1.14	50-53	40-50	--	--	--	--	--
	Developing	.78-1.71	38-56	25-44	0-15	--	0-13	0-10	--
	Full Farm	1.04-1.71	38-42	25-33	8-15	--	8-13	8-18	--
Central South	First Year*	.48-1.00	43-50	50-57	--	--	--	--	--
	Second Year	.65-1.14	40-50	40-50	--	--	0-20	--	--
	Developing	.78-1.71	35-50	33-50	0-15	--	0-13	--	--
	Full Farm	1.04-1.71	38-42	35-42	8-15	--	8-13	--	--

*Farmers who do not have animal traction.

In the report on the 1978 crop season it had already been noted that the AVV farmer did not apply the 150 kg/ha of fertilizer planned for by AVV. The fertilizer actually used is mainly put on the cotton (see Table 22). The first year farmers do apply more fertilizer on cotton than do the older farmers, but this difference is not significant, and there is no tendency for the older farmers to put less fertilizer on their cotton. The level of fertilizer applied averages about 120 kg/ha both for 1978 and 1979. (see also Table 22 and 23). The sorghum receives much less fertilizer than prescribed by AVV although the farmers in the sample used more on the average in 1979 than in 1978 (60 kg/ha to 40 kg in 1978). There is, however, a tendency for the older farmers to use less and less fertilizer on this crop. In the opinion of the farmer it is not rewarding to invest in crops which do not yield money.

The other crops always receive less fertilizer. The AVV does not promote those crops very much and the farmer uses only the leftover fertilizer to put on those crops. This is one of the main reasons why the fertilizer quantity per ha is so irregular (these are mostly small areas). It should be noted that about 77% of the settlers had never used fertilizers before joining the AVV.

In the original technical package, the AVV requested use of fertilizer on both sorghum and cotton, but in reality the use of NPK on sorghum has always been low and the AVV now only recommends it. The level of fertilizer recommended was chosen to preserve soil fertility, but the farmers often use a level far below that. It is therefore crucial that the AVV reconsider its entire position on farm management for maintaining soil fertility (crop rotation, inputs, fallow).

The level of insecticide actually used is slightly lower than the standards set by AVV (see Table 24). It depends very much on the number of insects on the cotton which was worse in 1979 than in 1978. In general the farmers follow very well the advice of the extension agents and spray the cotton at the right time. Most of the farmers never grew cotton before which might explain why they follow the AVV suggestion correctly.

On the cowpeas, most farmers spray much lower amounts than the recommended 7.5 kg/ha, and many simply empty their sprayer on the cowpeas after treating their cotton field. Many farmers do not spray the cowpeas at all because they use the leaves in cooking.

4. Labor Time

The AVV farm plan is designed so that every unit of labor cultivates between 1.2 and 2.3 ha (See II). This area (which includes the house compound) is large compared to the man/land ratio in the areas of origin of the settlers. In 1978 a fairly detailed labor study was undertaken on a sample of about 190 farmers to see whether this farm size was workable for the farmers. If there are bottlenecks in the agricultural operations they could be identified by this study and if possible quantified. In 1979 the same type of labor study was effectuated on a much larger but less detailed sample, to check the results of the 1978 survey.

TABLE 22. Average Quantities of NPK in kg/ha
Actually Used by AVV Settlers For The 1979 Crop Season

Cluster	Stage of Development	Cotton	White Sorghum	Red Sorghum	Corn	Cowpeas	Peanuts
Linoghin	Second Year	170	90	--	--	80	10
	Developing	90	60	40	--	20	10
	Full Farm	120	30	20	100	--	--
Mogtedo Bombore	First Year	140	140	--	--	--	--
	Second Year	150	130	--	--	--	--
	Developing	140	50	30	10	--	--
Bane	Full Farm	90	20	--	30	--	--
	First Year	130	100	--	--	--	--
	Developing	130	70	10	--	40	--
Kaibo Nord	Full Farm	130	30	--	--	--	--
	Second Year	90	--	--	--	--	--
	Developing	90	20	--	50	--	--
Kaibo Sud	Second Year	150	120	--	100	30	--
	Developing	140	10	20	30	--	--
	Full Farm	120	50	10	60	20	--

TABLE 23. Average Quantity of NPK in kg/ha
Used by AVV Settlers for the 1978 Crop Season

Cluster	Stage of Development	Cotton	White Sorghum	Red Sorghum	Corn	Cowpeas	Peanuts
Linoghin	First Year	180	160	--	--	--	--
	Developing	100	80	50	--	80	--
Mogtedo	First Year	130	180	--	--	--	--
	Second Year	110	120	--	--	--	--
	Developing	110	10	--	80	--	--
Bane	Second Year	100	50	--	--	--	--
	Developing	120	40	--	--	--	--
Kaibo Nord	Second Year	140	--	--	--	--	--
	Developing	120	--	--	--	--	--
Kaibo Sud	First Year	140	--	--	--	--	--
	Developing	70	20	20	--	20	--

TABLE 24. Use of Insecticide During the 1979 and 1978 Crop Seasons

Cluster	Stage of Development	Cotton			Cowpeas	
		Endrine	Nuvacron		Endrine	Nuvacron
		79	78	79	79	79
Linoghin	First Year	--	11.4		--	
	Second Year	9.8	--		--	
	Developing	8.7	6.1		2.3	
	Full Farm	7.2	--		2.6	
Mogtedo Bombore	First Year		11.0	12.5		--
	Second Year		7.4	16.5		5.6
	Developing		7.1	10.2		1.1
	Full Farm		--	11.6		--
Bane	First Year		--	11.0		
	Second Year		7.4	--		
	Developing		10.2	14.6		
	Full Farm		--	13.4		
Kaibo Nord	Second Year	6.4	9.7	10.7	2.3	
	Developing	8.4	6.6	10.4	1.9	
Kaibo Sud	First Year	--	8.5	--		
	Second Year	--	--	11.8		
	Developing	8.3	6.6	--		
	Full Farm	9.1	--	12.9		

The results of the time study are presented in units of labor-days, the units used in the inquiries. It should be noted that those are not days of eight hours and that there is a difference between the length of a day in the different operations. A sowing day lasts on the average longer than a weeding day.

The time spent for the agricultural activities varies rather widely. The rain pattern is one of the most important sources of variations but not the only one. Family size, type of soil and relative preference for a certain crop influence the labor effort put in the crop. Therefore the sample has to be fairly large in order to give a reliable estimate of the average number of labor-days spent for an operation. Differences in labor inputs between more experienced farmers and new farmers could not be found in this sample.

The plowing of a field takes in general 9-17 days per hectare. This is more than the 12 days considered standard.¹ The farmer has not yet much experience with animal traction, and his plowing is often very superficial.

The sowing of one hectare takes 10-17 labor days (including resowing) for cotton or sorghum. There are no significant differences between the labor input of those two crops. This time period of 13.5 days average is much longer than the usual 5-10 days, partly because of the requirement to sow in line. The farmer sows along a sowing rope which has to be set up line by line. This procedure will go faster as the farmers gain more experience. Some farmers have already invented a kind of rake to make scratches on the ground where the lines should be so the sowing could be speeded up.

The weeding of both cotton and sorghum takes about 24-29 labor days per hectare, of which 21-28 are labor days for the first weeding. Although both crops receive about the same amount of labor input, the cotton is more likely to receive a second weeding than the sorghum. Cotton is weeded first and on time so it requires less labor than sorghum. This labor input is similar to the standard duration (24 labor days). There is, however, a large group of farmers who put much less effort in the weeding. Many fields are invaded by weeds which affect the production significantly. This is especially true of the crops other than cotton and sorghum, which always receive less care.

Ridging is done less often and usually incorrectly, as farmers are afraid to use their oxen if the crop has grown too high. This is due to a lack of experience with the animal traction and the fact that most farmers start ridging too late.

Insecticide application is done during a time period when the farmer has plenty of time so data about that aspect is not very reliable.

The labor input for the harvest depends very much on the yield obtained. If the harvest is good, helpers will be available. They are

¹ Memento de l'agronome.

rewarded with part of the harvest production. In the case of the cotton, which takes much more time to harvest than the sorghum, people can also be hired from local villages nearby. Cotton harvest takes place after that of the sorghum, and the local villages don't grow cotton.

In Table 25 the data on labor input is combined with the AVV agricultural calendar for farm type III (5.25 labor units).

Per day a family of type III disposes of 5.25 labor equivalents and of two oxen. This means that the plowing of the entire farm, including the house compound, takes 17 working days. If the farmer can start in the beginning of May at the first rain, the plowing can be finished before the end of May with the help of an extra pair of oxen. The sowing can be done in time for all the crops (June). The weeding, however, taking 32 working days for the whole family, will come too late for most of the crops. The farmer will never start weeding if he has not finished sowing. The crop selection at AVV at the moment is such that all crops have to be planted nearly at the same time so this dilemma is unsolvable. It is even worsened by the advice of applying the fertilizer during plowing instead of at weeding for that will stimulate the crop growth but also the weed production.

TABLE 25. Agricultural Calendar According to AVV and Labor Inputs from a Sample

	Cotton	Sorghum	Other Crops	Compound*	Total
Area (ha)	2.25	1.50	2.25	0.75	6.75
Sowing period	June	June	June/July	up to farmer	
Weeding	10 days after sowing				
Labor inputs in labor days (inquiry on sample)					
Plowing	29.25	19.50	29.25	9.75	87.75
Sowing	30.50	20.25	30.38	10.13	91.14
Weeding (1)	55.13	36.75	55.13	18.38	165.39
(2)	4.5	3.0	4.5	1.5	13.5

*0.25 ha is taken up by the house.

In practice the farmer gives reasonable care only to the sorghum and cotton while the other crops are plowed and weeded only if there is time left. The agricultural calendar is overcharged in the sowing-weeding period if the farmer does a thorough job. Because of the large amount of land he is able to cultivate (compared to local standards) the farmer prefers a more extensive way of cultivation which gives him more

security. He also gives priority to social obligations and non-agricultural obligations which are not included in this labor time.

The farm size proposed by AVV is too large, compared to the labor availability, to be cultivated correctly, so extensive cultivation is unavoidable. This implies not only less labor input per hectare but also a lower fertilizer input and less erosion protection, and no improved fallow. The long term result will be a degradation of the soil and yields.

5. Use of Animal Traction

About 75% of the farmers who are in their second year at AVV do buy a pair of oxen on credit. It is planned that they will use animal traction for plowing the fields already under cultivation the previous year, and for weeding and ridging all the fields. In fact, the farmers do not use their oxen as much as planned. Plowing is often very superficial, and much of the weeding is done by hand (see Table 26). During the first few years, the use of animal traction is time-consuming, as 69% of the farmers have no previous experience with animal traction and need time to practice.

TABLE 26. Percentage of Fields Worked with Animal Traction for Cotton and Sorghum by Year of Experience (1978 and 1979 Crop Seasons)

Years of Experience with Ox Traction at AVV	Crop Season	Cotton					White Sorghum				
		Plowing 78	Plowing 79	Weeding 78	Weeding 79	Ridging 79	Plowing 78	Plowing 79	Weeding 78	Weeding 79	Ridging 79
1		39	100	6	70	62	0	69	0	24	11
2		94	100	73	38	24	95	80	70	30	--
3		100	100	71	44	10	100	70	93	10	--
4		100	100	100	71	26	100	33	94	33	4
5		--	100	--	80	37	--	93	--	54	17

The cotton fields are the only ones which are usually plowed and weeded by animal traction, as the farmer puts most of his effort in this cash crop (see also inputs). Because of the time involved in plowing the field by oxen, most of the farmers are not able to plow all their fields, so the less important crops (legumes and often even the white sorghum) are not plowed with oxen. The weeding is often done by hand because many farmers still have difficulties in guiding the oxen and are therefore afraid that the animals will damage their crop. Timing is also important in deciding how the weeding will be done; when the farmer is late, the crop is too high to work with the oxen. The farmers are also hesitant to take proper care of their oxen. In 1979, they spent only an average of 2,000 CFA to feed a pair of oxen and repair its equipment (not counting veterinarian

costs). This is very low compared to the 12,870 CFA planned for by the AVV (see Table 13, p. 19).

6 Agricultural Production

6.1 Cotton

Cotton, the only cash crop, is cultivated on about 40% of the farm area (excluding house compound). The yields achieved by AVV farmers are good, 1100 kg/ha in 1979, which is higher than AVV standards (see table 27).

There are several factors involved. Most of the AVV farmers did not grow cotton before, so they are more willing to rely on the advice of the AVV extension service. The technical package for the cotton (seed variety, quality and quantity of fertilizer and insecticide) seems to be well balanced and is applied by most of the farmers.

The results in table 27 are presented according to the type of tillage: mechanical, animal or manual. There is no evidence from the results of these three crop seasons that tillage has an important influence on the yields.

Fertilizer is used by most of the farmers at a level close to the AVV standards. It is therefore very difficult to evaluate the impact of fertilizer on yield since there are other factors involved which provide much more important restrictions (rainfall, soil quality, etc.).

Given the technical background of the AVV farmer, it can be concluded that the cotton production is reaching its full potential. The farmers apply the recommended levels of fertilizer and insecticides, and they try to weed on time; most do two weedings and some do a ridging. The cotton is given priority over other crops if necessary.

Cotton is heavily promoted by AVV, and the farmers depend on that crop for the cash they need to repay their AVV loans. In the future, when the farmers' need for cash will be lower (animal traction is paid off after seven years) it is quite possible that the farmers will reduce their effort on this crop, because it takes much more work than other crops. An indication of this is the fact that some older farmers did not do a third picking in 1979 but burned their cotton field while there was still cotton to be harvested.

6.2 White Sorghum

White sorghum is the most important food crop. Even at the AVV, where cotton is cultivated on a large part of the farm area, white sorghum is cultivated on more than 50% of the acreage. The yields achieved during the last three crop seasons are presented in table 28. Deep plowing of the field by the AVV does not have a positive influence on yields.

It is also not possible to show any difference between the yields obtained at the different stages of farm development; differences are due more to the location of the farmer (rainfall and soil differences)

TABLE 27. Average Yield in kg/ha for Cotton per Cluster of AVV Villages and Phase of Development of the Farm for the Crop Seasons 1977-1979.

Cluster of Villages	Crop Season	Stage of Farm Development									
		First Year	Second Year			Developing Farm			Full Size Farm		
		Plowed by AVV	Plowed by AVV	Plowed by Oxen	Not Plowed	Plowed by AVV	Plowed by Oxen	Not Plowed	Plowed by AVV	Plowed by Oxen	Not Plowed
Linoghin	1977	--	--	--	--	810	--	--	--	--	--
	1978	1570	--	--	--	990	--	--	--	--	--
	1979	--	1300	1300	820	1020	970	--	1000	940	--
Mogtedo Bombore	1977	340	--	--	--	720	--	--	--	--	--
	1978	1530	720	--	--	1070	--	--	--	--	--
	1979	1690	1350	1520	--	1360	930	--	1190	640	--
Bane	1977	1000	--	--	860	--	1260	--	--	--	--
	1978	--	--	--	1340	--	1290	1330	--	--	--
	1979	1230	--	--	--	--	930	--	--	1100	--
Kaibo Nord	1977	740	--	500	450	--	--	--	--	--	--
	1978	--	--	--	1710	--	1440	1180	--	--	--
	1979	--	--	1370	--	--	1080	990	--	--	--
Kaibo Sud	1977	--	--	--	--	--	610	--	--	--	--
	1978	1180	--	--	--	--	1380	--	--	--	--
	1979	--	--	1510	--	--	810	--	--	1010	--

TABLE 28. Average Yield in kg/ha for Sorghum per Cluster of AVV Villages and Phase of Development of the Farm for the Crop Seasons 1977-1979.

Cluster of Villages	Crop Season	Farm Development Stage									
		First Year	Second Year			Developing Farm			Full Size Farm		
		Plowed by AVV	Plowed by AVV	Plowed by Oxen	Not Plowed	Plowed by AVV	Plowed by Oxen	Not Plowed	Plowed by AVV	Plowed by Oxen	Not Plowed
Linoghin	1977	--				--	1070		--	--	--
	1978	930	--	--	--	--	450	--	--	--	--
	1979	--	--	780	850				--	540	--
Mogtedo Bombore	1977	660	--	--	--				--	--	--
	1978	830	--	740	--	--	580	--	--	--	--
	1979	460	--	1260	*	--	700	800	--	900	660
Bane	1977	890	--	--		1160			--	--	--
	1978	--	1120			1140	--	950	--	--	--
	1979	600	--	--	--	430	500	--	600	700	--
Kaibo Nord	1977	780	360		280	--	--	--	--	--	--
	1978	*	520			600		610	--	--	--
	1979	--	480	*	*	310	620	560	--	--	--
Kaibo Sud	1977	--	--	--	--	570			--	--	--
	1978	470	--			790		670	--	--	--
	1979	--	460	--	--	230	--	--	130	210	--

In 1979 an important part of the yield was damaged because of striga (Bane) and waterlogging (Koulipele).

The farmer has a long tradition of growing sorghum. It is therefore difficult for the AVV to change his habits and have him apply the AVV technical package correctly.

The AVV has adapted its strategy to this situation and does not demand any more from the farmer than that the full dose of 150 kg of fertilizer be used on sorghum. The extension agent, however, advises the farmer to use fertilizer. Many farmers use a quantity of NPK which is far too low to produce any noticeable results (less than 40 kg/ha). Early planting is also important and does not cost money, but even in a case where the farmer planted on time the levels of fertilizer applied do not seem to pay off. The long term effect of little or no fertilizer use cannot yet be evaluated at this stage of the AVV. The variations in crop yields are very big, probably because of differences in weeding and specific situations of the field (waterlogging in low parts, cuirasse, etc.). It is rare that the farmer weeds in time (within two weeks of sowing). Much of the yield potential of white sorghum is then lost, blurring any effect of the fertilizer.

6.3 Other Crops

- Red Sorghum

Red sorghum is mostly cultivated in Bane and Kaibo Sud (table 29). It is an easy crop to grow, often the first one to be planted, without land preparation. In 1979, most farmers planted the red sorghum before the end of May, and the harvest was due in September (Bane) and October. It fits well with other agricultural tasks and does not interfere with the cultivation of either white sorghum or cotton. Little fertilizer, if any, is used. Red sorghum is mostly used to make beer; indeed beer selling can be a steady source of income for the women. The yields are good every year in Bane. More than 20% of the farmers had yields over 1100 kg/ha in 1979 but they are quite below the standard 1000 kg/ha in the other clusters.

- Maize

More farmers have been cultivating maize in their bush fields in 1979; in previous years it had been cultivated almost exclusively in the house gardens. When fertilizer is used, it is usually in higher quantities than on other cereals (see table 22). Table 29 gives the yields achieved in the bush fields, but there are great variations among farmers.

- Cowpeas

The yields achieved have been close to AVV standards of 500-700 kg/ha (table 29), but the area cultivated is much smaller than what had been planned in the rotation. Again, fertilizer is rarely used, and mostly in small quantities. Insecticides are not always applied, and when they are it is in small quantities. Many farmers simply "rinse" their sprayer on the cowpeas after spraying their cotton field.

TABLE 29

Average Yield in kg/ha for All Crops Except Cotton and White Sorghum for the Crop Seasons 1977 to 1979.

Cluster of Villages	Crop Season	Red Sorghum	Maize	Cowpeas
Linoghin	1977	--	--	--
	1978	340	--	710
	1979	390	590	550
Mogtedo Bombore	1977	--	800	870
	1978	--	520	570
	1979	500	660	780
Bane	1977	1130	--	380
	1978	1130	--	780
	1979	910	--	730
Kaibo Nord	1977	540	--	--
	1978	--	--	--
	1979	740	1010	450
Kaibo Sud	1977	1150	730	660
	1978	590	900	930
	1979	650	560	490

- Peanuts

In traditional agriculture, the peanuts are mainly cultivated on individual plots. At the AVV, there are no individual plots and the cultivation of peanuts in the bush fields is not frequent perhaps because it is difficult to sell peanuts in large quantity. Most families grow some peanuts in their gardens. Fertilizer is hardly ever used, and the yields are irregular (290 kg/ha on the average in 1978, 900 kg/ha in 1979, on small samples).

- Rice

The AVV did not plan for rice cultivation but it is done by some farmers near river beds and in the wetter parts of some fields. Little fertilizer is used. The average yield was 790 kg per hectare in 1978, 920 kg per hectare in 1979 but there are tremendous variations, some fields having been total failures.

- Millet

Millet is not often grown in the bush fields, and always on small areas. No fertilizer is used. The yields were good in Mogtedo in 1979 (1250 kg/ha); they have been lower than the standard 600 kg/ha in Lino-ghin (240 kg/ha in 1978, 440 kg/ha in 1979).

6.4 House Garden

The settlers are free to cultivate their house garden as they wish; it is therefore interesting to note which elements of the technical package they elect to use (table 30). Over the years, the vast majority of the settlers chose to plow their house garden with their oxen, and to sow in rows. Weeding is done by hand, before or after the regular day's work in the bush fields, which always takes priority. Fertilizer is rarely applied, but sometimes manure from the oxen is used. In 1979, some farmers did not cultivate the entire garden, either because they had been delayed in planting their bush fields, or because of the poor quality of the soil.

Most of the garden is planted with cereals, usually maize, red sorghum and white sorghum (although Bane always prefers red to white sorghum). In 1979, the majority of the older farmers in Kaibo Sud and Kaibo Nord chose not to plant any white sorghum at all; these are the clusters which have had a large rate of failures in their white sorghum fields because of water logging (Kaibo Sud and Nord) and diseases (Kaibo Nord). Instead, they have emphasized red sorghum and maize. Those who do cultivate some white sorghum in their house garden usually choose local varieties, except in their first year at AVV, when the AVV variety is more readily available.

Intercropping of cereals and cowpeas is often done. Other crops include peanuts, vegetables, spices, calabash and hemp (used for its fiber).

TABLE 30

Farming Techniques Used on the House Garden,
in Percentages of Sample Population in 1979.

Stage of Development	Plowing			Sowing			Variety	
	None	Manual	Oxen	Traditional	In Row and Tra- ditional	In Row	White Local	Sorghum AVV
1st. Year	86	11	3	86	0	14	23	77
2nd Year	39	6	55	30	5	65	90	10
Developing	44	19	37	36	11	53	65	35
Full	6	1	93	13	9	78	60	40

It is difficult to estimate the yield of each crop in the house garden, and complete data is available only for part of the sample. The total cereal production of the .8 ha put under cultivation averages 580 kg in Linoghin, 370 kg in Bane and 730 kg in Koulipele (sum of the total production in white sorghum, red sorghum, maize and millet).

7 Agricultural results at the farm level

7.1 Introduction

Until now, the results were given by crop for the whole sample. It is important to consider the results achieved at the farm level in order to understand what it means for each family.

Farm level results will be calculated as follows (see figure 2). The production of each field has been measured. The value of that production is calculated at local market prices, then the true cost of inputs (seeds, fertilizer and insecticides) is subtracted. This gives the gross result of each field. The sum of these results plus the value of the production of the house garden gives the gross result of the farm.

The fixed costs (tools, animal traction) are then subtracted to obtain the net result of the farm. In order to compare farms that vary in acreage and labor size, it is useful to divide the gross and net results of each farm by the labor index of the family. These results per unit of labor are compared within each cluster of villages and then between clusters.

The price used in calculating the value of each production are averages from a two-year study in larger local markets (see V-2-2), and are listed in table 31. For cotton, it is estimated that 90% of the production will be of first quality (sold at 55 CFA/kg) and 10% of second and third quality (sold at 45 CFA/kg). The cereals of the house compound, which are a mixture of white and red sorghum, and corn, are evaluated at an average price of 58 CFA/kg.

Table 31. Prices Used to Calculate the Value of Agricultural Production in CFA per kg.

Crop	Price in CFA/kg
Cotton	54
White sorghum	62
Red sorghum	55
Maize	57
Cowpeas	79
Peanuts (in shell)	81
Rice	72
Millet	65
Cereals (house compound)	50

FIGURE 2
Calculation of the Results per Farm.

	Cotton	White Sorghum	Other
Value of Agricultural Production per Crop.	Quantity X CFDT Price	Quantity X Market Price	Quantity X Market Price
MINUS			
Variable Expenses by Crop	Cost of Fertilizer and Insecticide Used (on credit)	Cost of Seeds and Fertilizer Used (on credit)	Cost of Seeds, Fertilizer, and Insecticide Used (on credit)
EQUALS			
Gross Results per Crop			
TOTAL SUM			
Gross Results per Farm		Divided by the Family Labor Index	Gross Results per Labor Unit
PLUS			
Value of the Production of the House Garden		See IV-6-4	
MINUS			
Fixed Expenses:-----		(Cost of Credit of Animal Traction Cost of Credit of Animal Upkeep Rental of Pulverizer	
EQUALS			
Net Results of the Farm-----		Divided by the Family Labor Index =	Net Results per Labor Unit
MINUS			
Food Needs of the Family		See IV-7-3 (Market Price)	
EQUALS			
Net Surplus per Farm-----		Divided by the Family Labor Index =	Net Surplus per Labor Unit

The primary use of the agricultural production, aside from cotton, is to assure the subsistence of the family. It is, therefore, important to calculate for each family whether the production is adequate to feed its members, and what surplus is eventually available. Here again, the results will be given per cluster and per year of arrival at AVV.

The agricultural production represents only one of the sources of income of the families. Other activities will be discussed in the last section of this chapter.

7.2 Gross Agricultural Results

Table 32 shows the average gross results for bush fields per unit of labor in each cluster. The families are grouped per class of labor index, and the results are given for the four stages of development of the AVV farm. As was already noted in 1978 the gross income per unit of labor is usually higher for the smaller families. As in 1978,¹ the

TABLE 32
Gross Revenue in CFA by Labor Unit
According to the Labor Index and Cluster in 1979
(Data from a Sample)

Cluster	Stage in Farm Development	Classes of Unit of Labor in the Family				Average
		1.75 - 2.25	2.50 - 3.25	3.50 - 4.50	4.75 & Over	
Lingohin	Second year*	66,700	40,800	--	--	51,900
	Second year	71,700	64,200	29,400	38,900	71,700
	Developing	67,100	54,900	--	54,600	63,100
	Full farm	--	48,500	63,700	39,800	53,300
Mogtedo	First year*	48,500	35,600	52,300	26,200	40,400
Bombore	Second year*	78,800	54,000	--	--	68,900
	Second year	--	--	--	64,400	61,000
	Developing	64,500	67,400	39,800	36,100	53,400
	Full farm	74,000	74,100	52,500	51,400	63,100
Bane	First year*	67,500	41,700	31,000	--	44,900
	Developing	90,000	76,900	53,600	35,300	67,200
	Full farm	88,200	--	78,100	44,000	72,900
Kaibo Nord	Second year	--	--	38,200	50,000	43,900
	Developing	69,300	55,700	52,200	43,200	59,000
Kaibo Sud	Second year	44,900	40,700	37,400	40,300	39,800
	Developing	25,800	24,160	23,700	--	23,600
	Full farm	33,000	36,200	39,100	22,900	33,000

* Farmers which are not equipped.

¹ See Annex III-2 for the results of the 1978 crop season.

farmers in Bane have the highest results, followed closely by the older farmers in Mogtedo. The poor results in Kaibo Sud are due to the almost total failure of the white sorghum crop.

Table 33 shows the average area cultivated per unit of labor for the same classes as table 32 (house compound excluded). It shows that the smaller families also cultivate a larger area per unit of labor.

It has been seen earlier that the families sometimes have a higher labor index than the one they had officially received (see IV.2) and that the farmers cultivate more land than they are supposed to according to their index. It is therefore important to know if there is a correlation between the amount of land cultivated per unit of labor and the gross result of the farm per unit of labor. It is the gross result of all the bush fields which is used (value of the production less variable costs such as fertilizer and insecticides), before subtraction of the cost of animal traction.

The 1978 data had shown that families who cultivate larger areas per unit of labor have a tendency to obtain a larger income, as they use a more extensive maintenance than that recommended by AVV regardless of the amount of land they cultivate. This is again found in the 1979 data (Graph 1) except in the cluster of Kaibo Sud, where the poor sorghum harvest decreased the gross income. In the other clusters, the correlation coefficient is around 0.6, which shows that the amount of land put under cultivation does influence the gross income, but also that other factors are involved. This result should not be interpreted too strictly for changes in prices influence the result of this correlation.

Table 34 shows the same gross result at the farm level for the 1978 and 1979 crop seasons, compared to the result which would be achieved should the farmers cultivate the area allocated to them and harvest the standard yields.

The gross results at the farm level are well within previsions, and often even exceed them. In order to understand this, it is necessary to compare the total acreage actually put under cultivation with the AVV previsions.

7.3 Evolution of the Acreage Under Cultivation

The AVV model includes a regular increase in amount of land put under cultivation during the first five years, the specific amount depending upon the category of the farm (its category is determined by its labor index, see II.1.2). Table 35 shows this evolution for the categories usually found at AVV according to the AVV program, table 36 shows the same evolution using real data from the 1977 crop season (see annex III-4 for the 1978 crop season). As a rule, the settlers do cultivate more land than they are supposed to, as the families' labor force often exceeds their official index. The size of the labor force is very flexible, because family members from the village of origin are always ready to come join the AVV settler if it seems that enough land is available. This is a social dimension which is usually overlooked in an economic prefactibility study, but it is a very basic one in developing

TABLE 33

Average Area Cultivated per Unit of Labor (Excluding House Garden)
by Index of Activity of the Family and Cluster of Villages in 1979¹

Cluster	Stage in Farm Development	Class of Units of Labor			4.75 & Over
		1.75 - 2.25	2.50 - 3.25	3.50 - 4.50	
Lingohin	Second*	1.29	.72	--	--
	Second	--	1.08	.77	.72
	Developing	--	1.67	--	1.50
	Full	--	1.77	1.79	1.46
Mogtedo and Bombore	First*	.92	.70	.80	.50
	Second*	1.47	--	--	--
	Second	--	--	--	.79
	Developing	1.48	1.21	.85	.60
	Full	1.43	1.28	1.04	.98
Bane	First	1.22	.88	.70	--
	Developing	2.11	--	1.32	.96
	Full	2.08	--	1.44	1.10
Kaibo Nord	Second	--	--	1.11	--
	Developing	1.94	1.54	1.12	1.21
Kaibo Sud	Second	--	1.06	.76	--
	Developing	--	1.30	--	--
	Full	1.83	1.79	1.24	1.05

* Farmers without animal traction.

¹ The areas cultivated in 1978 per class of units of labor are presented in Annex III-3.

Relation Between Income per unit of Labor and Area Cultivated

per unit of Labor (excluding the house compound)
(data from 1979 crop season)

Income (X
1000 CFA per
unit of labor
(Labor))

80

60

40

20

10

20

Area (ha)
cultivated per unit
of labor

Mogtado

Bane

Kaibo Nord

Linoghin

Kaibo Sud

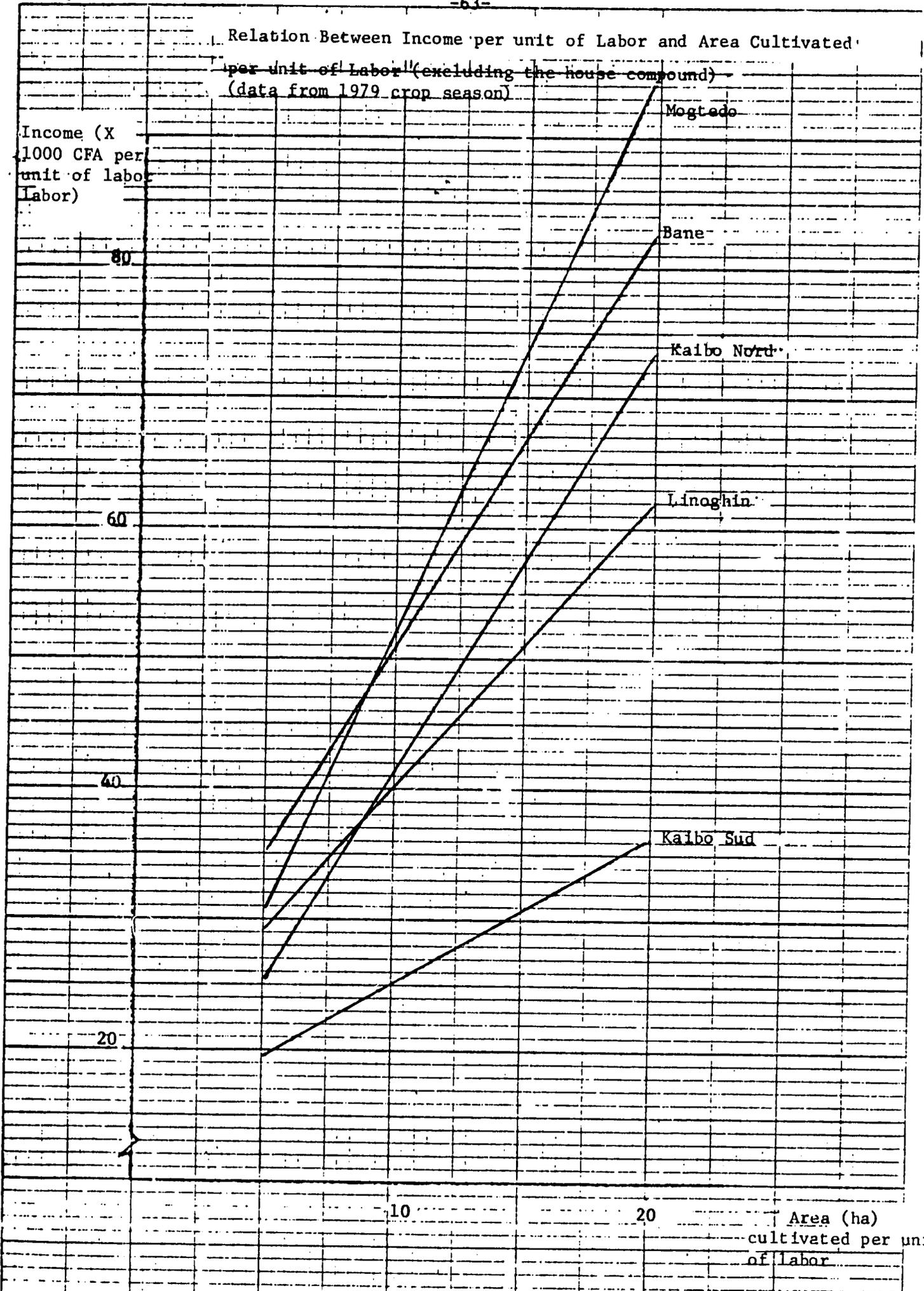


Table 34

Gross Results (Net Value of Crops in CFA) of an AVV Farm (Type I-III)
According to Geographical Location and Phase of Development at the AVV.

Family Type	Crop Season	Linoghin				Mogtedo Bombore				Bane				Kaibo Nord		Kaibo Sud			
		First Year	Second Year	Developing Farm	Full Farm	First Year	Second Year	Developing Farm	Full Farm	First Year	Second Year	Developing Farm	Full Farm	Second Year	Developing Farm	First Year	Second Year	Developing Farm	Full Farm
IA	1978	113,200	--	137,400	--	105,500	80,600	165,900	--	--	263,600	280,600	--	113,500	125,600	83,600	--	143,300	--
	1979	--	119,200	--	180,500	85,000	--	127,500	164,700	107,000	--	145,700	--	--	128,100	--	99,600	94,800	84,200
	prevu	80,700	90,700	100,300- 138,000	138,000	80,700	90,700	100,300- 138,000	138,000	80,700	90,700	104,300- 138,200	138,200	90,700	104,300- 138,200	80,700	90,700	104,300- 138,200	138,200
IB	1978	103,200	--	131,900	--	96,900	104,200	161,900	--	--	282,900	281,300	--	--	139,900	100,000	--	158,900	--
	1979	--	162,800	--	--	--	170,400	149,200	189,200	124,300	--	161,600	218,400	--	141,000	--	115,600	--	105,700
	prevu	90,300	100,300	138,000- 185,300	185,300	90,300	100,300	138,000- 185,300	185,300	90,300	115,600	138,700- 185,800	185,800	115,600	138,700- 185,800	90,700	115,600	138,700- 185,800	185,800
II	1978	125,500	--	186,600	--	117,100	--	227,800	--	--	--	249,300	--	217,800	228,100	--	--	261,500	--
	1979	--	140,000	--	--	132,300	--	181,300	185,100	116,600	--	176,900	204,400	--	183,200	--	--	137,400	118,200
	prevu	112,900	137,500	160,700- 231,000	231,000	112,900	137,500	160,700- 231,100	231,100	112,900	140,500	161,400- 231,600	231,600	140,500	161,400- 231,600	112,900	140,500	161,400- 231,600	231,600
III	1978	184,000	--	199,800	--	173,500	--	243,100	--	--	--	370,200	--	--	237,300	--	--	273,800	--
	1979	--	213,900	--	--	--	254,300	216,300	291,400	--	--	--	262,000	--	237,500	--	--	--	--
	prevu	125,900	169,800	206,500- 277,900	277,900	125,900	169,800	206,500- 277,900	277,900	125,900	176,700	207,200- 278,600	278,600	176,700	207,200- 278,600	125,900	176,700	207,200- 278,600	278,600

Table 35

Evolution of an AVV Farm (Type I-III) to Its Full Size.
 Acreage to be Cultivated per Crop and Phase of Development of the Farm
 (from Mise e Valeur 1978).

Family Type	Crop	Acreage in ha. in the Different Stages of Development of the Farm							
		Northern Zone				Central and Southern Zones			
		First Year	Second Year	Developing Farm	Full Farm	First Year	Second Year	Developing Farm	Full Farm
1A	Cotton	.75	1.00	1.25	1.25	.75	1.00	1.00-1.25	1.25
	White Sorghum	1.00	1.00	1.00	1.00	1.00	1.00	1.00-1.25	1.25
	Red Sorghum	--	--	0-.25	.25			.25	.25
	Cowpeas			0-.25	.25			0-.25	.25
	Peanuts*								
	Millet			0-.25	.25				
	Total	<u>1.75</u>	<u>2.00</u>	<u>2.25-3.00</u>	<u>3.00</u>	<u>1.75</u>	<u>2.00</u>	<u>2.25-3.00</u>	<u>3.00</u>
1B	Cotton	1.00	1.25	1.25-1.50	1.50	1.00	1.00	1.25-1.50	1.50
	White Sorghum	1.00	1.00	1.00	1.00	1.00	1.00	1.00-1.50	1.50
	Red Sorghum			.25-.50	.50			.50	.50
	Cowpeas		.25	.25-.50	.50		.25	.25-.50	.50
	Peanuts*						.25		
	Millet			.25-.50	.50				
	Total	<u>2.00</u>	<u>2.50</u>	<u>3.00-4.00</u>	<u>4.00</u>	<u>2.00</u>	<u>2.50</u>	<u>3.00-4.00</u>	<u>4.00</u>
II	Cotton	1.25	1.50	1.50-2.00	2.00	1.25	1.25	1.50-2.00	2.00
	White Sorghum	1.25	1.25	1.25	1.25	1.25	1.25	1.25-1.75	1.75
	Red Sorghum			.25-.75	.75			.50-.75	.75
	Cowpeas		.25	.25-.50	.50		.50	.25-.50	.50
	Peanuts*								
	Millet			.25-.50	.50				
	Total	<u>2.50</u>	<u>2.50</u>	<u>3.25-5.00</u>	<u>5.00</u>	<u>2.50</u>	<u>3.00</u>	<u>3.50-5.00</u>	<u>5.00</u>
III	Cotton	1.25	2.00	2.00-2.25	2.25	1.25	1.50	2.00-2.25	2.25
	White Sorghum	1.50	1.50	1.50	1.50	1.50	1.50	1.50-2.25	2.25
	Red Sorghum			.50-.75	.75		.75	.75	.75
	Cowpeas		.25	.25-.75	.75		.75	.25-.75	.75
	Peanuts*								
	Total	<u>2.75</u>	<u>3.75</u>	<u>4.50-6.00</u>	<u>6.00</u>	<u>2.75</u>	<u>3.75</u>	<u>4.50-6.00</u>	<u>6.00</u>

*In the Central and Southern Zones, no peanuts are cultivated.

Table 36. Evolution of an AVV Farm (Type I-III) to its Full Size. Acreage Cultivated per Crop and per Phase of Development of the Farm in 1975 (Data from Sample).

Family Type	Crop	Acreage in ha. in the Different Stages of Development of the Farm														
		Linoghin			Mogtedo Bombore				Bane			Kaibo Nord	Kaibo Sud			
		Second Year	Developing Year	Full Farm	First Year	Second Year	Developing Farm	Full Farm	First Year	Developing Farm	Full Farm	Developing Farm	Second Year	Developing Farm	Full Farm	
IA	Cotton	1.20	1.9	1.5	.8		1.3	1.3	1.3	1.4		1.3	1.0	1.0	1.1	
	White Sorghum	1.10	2.1	1.5	.9		1.2	1.7	1.0	1.1		1.5	1.0	1.0	2.0	
	Red Sorghum	--	.6	.1	--		--	--	--	1.2		.5	--	.6	.2	
	Cowpeas	--	.1	.4	--		--	.2	--	--		.2	--	.1	.2	
	Peanuts*	--	--	.1	--		--	--	--	--		--	--	--	--	
	Millet	--	--	.7	--		--	--	--	--		--	--	--	--	
	Other	--	--	.4	--		.1	--	--	--		--	--	--	--	
	Total	<u>2.3</u>	<u>4.7</u>	<u>4.7</u>	<u>1.7</u>		<u>2.6</u>	<u>3.2</u>	<u>2.3</u>	<u>3.7</u>		<u>3.5</u>	<u>2.1</u>	<u>.8</u>	<u>.3</u>	
IB	Cotton	1.5				1.3	1.2	1.6	1.6	1.4		1.4	1.0		1.3	
	White Sorghum	1.4				1.1	1.5	1.5	1.0	1.5	1.9	1.6	1.1		2.2	
	Red Sorghum	--				--	.1	--	--	1.2	.9	.5	.1		.2	
	Cowpeas	.2				.1	--	.3	--	.1	--	.2	.2		.2	
	Peanuts*	--				.1	.1	--	--	--	--	--	--		--	
	Millet	--				--	--	--	--	--	--	--	--		--	
	Other	.1				--	.2	.3	--	--	--	--	--		--	
	Total	<u>3.2</u>				<u>2.6</u>	<u>3.1</u>	<u>3.7</u>	<u>2.6</u>	<u>4.2</u>	<u>4.8</u>	<u>3.8</u>	<u>2.7</u>	<u>.3</u>	<u>.7</u>	
II	Cotton	1.2	3.2		1.3		1.5	1.4	1.3	1.4	1.8	1.8		1.3	1.3	
	White Sorghum	1.4	3.9		1.8		1.6	2.1	1.3	1.7	1.9	1.9		1.6	2.3	
	Red Sorghum	--	.8		--		.1	--	--	1.4	.8	.6		--	.2	
	Cowpeas	.2	.1		--		.1	.1	--	.1	--	.2		--	.2	
	Peanuts*	--	--		--		.1	--	--	--	--	--		--	--	
	Millet	--	.2		.2		.2	--	--	--	--	--		--	--	
	Other	--	--		--		.1	--	--	--	--	--		--	--	
	Total	<u>2.8</u>	<u>8.2</u>		<u>2.5</u>		<u>3.7</u>	<u>3.6</u>	<u>2.6</u>	<u>4.6</u>	<u>4.5</u>	<u>4.8</u>	<u>.3</u>		<u>1.3</u>	<u>1.0</u>
III	Cotton	2.0	4.0			2.1	1.8	2.4			1.8	2.2				
	White Sorghum	1.9	3.2			1.5	2.2	3.2			2.2	2.3				
	Red Sorghum	--	1.4			--	--	--			1.7	.4				
	Cowpeas	.3	.6			.2	.2	.1			--	.2				
	Peanuts*	--	.2			.1	.1	--			--	--				
	Millet	--	.7			--	--	--			--	--				
	Other	--	--			--	--	--			--	--				
	Total	<u>4.2</u>	<u>10.1</u>			<u>3.9</u>	<u>4.4</u>	<u>5.7</u>			<u>5.7</u>	<u>6.0</u>	<u>.9</u>			

*In the Central and Southern Zones, no peanuts are cultivated.

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countries; as an individual's income increases, so do his social obligations.

The provisions for steady increases in total farm income were made for a static family, one which would have cut its ties with its kin at the village of origin. This is an extremely drastic step in social change and most farmers would be reluctant to take it, as they depend upon their extended family in case of need.

7.4 Net Agricultural Result per Unit of Labor

The net agricultural result is calculated by adding the value of the production of the house garden (see 6-4) to the gross results of the bush fields and then subtracting the costs of those inputs that cannot be attributed to a specific crop, such as the cost of tools (Table 37), and eventually the annuities due the AVV Credit Service for the oxen and equipment (see II.2.4) and the cost of upkeep of animal traction. Until now, the settlers have spent very little to repair their equipment, much less than planned (see II.2.4).

The net agricultural result is then divided by the labor index of the family to obtain the net agricultural result per unit of labor. Table 38 compares the net results per unit of labor achieved in the various clusters during 1977, 1978, and 1979.

These net results are fairly stable. The clusters of Bane and Mogtedo usually have the best results per unit of labor, those of Kaibo Nord and Sud are more irregular. After the first year, there is no tendency for the income per unit of labor to increase as the acreage under cultivation increases, because the size of the labor force is itself increasing.

7.5 Off Farm Activities

Even though farming is the main activity of AVV settlers, most families have other activities and sources of income, mostly livestock, craft making and petty trade. Data has been gathered on these activities during the weekly interviews of the sample. Additional data has been gathered during a survey of a smaller sample (78 families) to learn the type of activities in which the family had been involved in the village of origin, activities now performed at AVV, and future plans for off-farm diversification.

- Livestock

Small livestock and poultry are ubiquitous in traditional compounds, and this activity has been maintained by AVV farmers (table 39). It includes cattle, sheep, goats, hogs and poultry.

The settlers do not often buy animals but rely on birth to increase their herd (table 40).

Twenty-five to 40% of the losses are due to accidental deaths (table 41). The livestock and more so the poultry, are slaughtered for rituals and celebrations, or are sold at local markets throughout the year when

Table 37

Average Expenses (in CFA) for Small Agricultural Equipment for a Family of Five Workers
(3.6 Standard Units of Labor) by Phase of Development of the Farm for the 1978 and 1979 Crop Seasons.

Stage of Development	Type of Expenditure							
	1978				1979			
	Hand Tools		Animal Traction		Hand Tools		Animal Traction	
	Purchases	Repairs	Parts	Repairs	Purchases	Repairs	Parts	Repairs
Second year	915	45	500	40	781	22	124	8
Developing	730	40	1660	270	799	22	1298	94
Full farm	--	--	--	--	953	54	1050	300

Table 38

Net Agricultural Income per Unit of Labor
for the Crop Seasons 1977-1979.

Cluster	Stage of Development	Average Net Income per Unit of Labor in CFA in Crop Season		
		1977	1978	1979
Linoghin	First year*	--	48,700	--
	Second year*	--	--	58,400
	Second year	--	--	53,100
	Developing	55,700	51,700	66,300
	Full farm	--	--	57,300
Mogtedo Bombore	First year*	--	60,300	48,000
	Second year*	--	54,200	75,400
	Second year	--	--	66,400
	Developing	62,200	50,500	56,600
	Full farm	--	--	65,800
Bane	First year*	--	--	49,100
	Developing	--	106,600	66,900
	Full farm	--	--	72,100
Kaibo Nord	Second year	--	--	51,700
	Developing*	--	25,900	--
	Developing	--	62,300	64,800
Kaibo Sud	First year*	--	39,100	--
	Second year	--	--	47,600
	Developing	56,100	62,600	29,400
	Full farm	--	--	38,100

* farms without animal traction

Table 39

Livestock Activity Before and After Settling at the AVV
(Data from a Sample of 78 Families), in Percentages.

Type of Livestock	Village of Origin	AVV Village
Cattle	64	71
Sheep	100	77
Goat	100	100
Pig	23	15
Poultry	100	100

Table 40

Type of Transaction Involved in Acquiring Livestock in 1979
(Data from a Weekly Survey of Families).

Type of Transaction	Linoghin	Bane	Kaibo Nord	Kaibo Sud
Local market	2.0	7.2	10.4	8.7
AVV market	2.3	8.9	0	0
AVV warehouse	2.0	3.8	.4	.3
Birth	75.2	58.1	79.3	84.0
Gift received	3.8	2.5	2.7	.7
Other	12.2	16.5	3.9	2.8
Unknown	2.3	2.5	3.4	3.4

Table 41

Type of Transaction Involved in Disposing of Livestock in 1979
(Data from a Weekly Survey of Families).

Type of Transaction	Linoghin	Mogtedo	Bane	Kaibo Nord
Local market	11.2	19.3	13.4	31.6
AVV market	6.8	1.1	12.6	.2
Gift given	8.2	5.7	7.8	2.8
Death	25.3	35.0	40.7	33.3
Slaughtered	26.2	26.5	16.9	16.3
Other	20.0	9.7	6.9	13.3
Unknown	2.3	2.5	1.7	2.5

cash is needed. Many farmers have been asking for help in improving their livestock activity (for example, there is an extremely high death rate among chickens from predators and cholera).

Some extension effort on improved livestock and poultry raising could give positive results in a short time.

- Handicraft Activities

Most AVV families are less active in handicrafts than they used to be (see table 42), except for the making of yokes and farming tools. The constraint most often mentioned is lack of funds, followed by lack of time.

Table 42. Frequency of Handicraft Activities at the Village of Origin and at the AVV Village in a Sample of 78 Families Settled for at Least 2 Years.

Type of Craft	Village of Origin	AVV Village
Weaving mats	95	79
Weaving fabric	85	32
Spinning cotton	80	58
Basket making	47	26
Sewing and knitting	40	27
House building	14	8
Mechanics	13	12
Smith	13	8
Furniture making	8	1
Making yokes and farming tools	8	12
Carpenter	6	6

It should be remembered that during the period after harvest which would usually be devoted to crafts, AVV settlers are busy destumping new fields and visiting their village of origin. Processing of agricultural produce is also lower (table 43). The income from handicraft and sales

Table 43. % of Families Involved in Processing of Agricultural Produce Before and After Settling at AVV (Sample of 78 Families).

Produce	Village of Origin	AVV
Maize	54	31
Millet	58	28
Peanut	37	17
Rice	33	17
Karite	55	24
Others	15	9

of produce transformed on the farm (such as local beer) varies greatly between families, some deriving a yearly income of more than 100,000 CFA while others have no income from such activities (table 44). Everywhere, the mean income increases as the families have been settled longer at AVV, but actual income varies greatly with the geographical location, although not with access to a market.

Table 44. Mean Income per Family in 1979 from Sale of Handicraft and Produce Processed on the Farm (Data from a Sample).

Stage of Development	First Year	Second Year	Developing Farm	Full Farm	Average
Linoghin	--	1800	6158	13,834	6627
Mogtedo Bombore	495	6627	19,670	13,791	9715
Bane	5356	--	5882	23,671	11,343
Kaibo Nord	--	2216	6181	--	3593
Kaibo Sud	--	3633	5938	4462	4028

In most cases, such income is fairly low, a few 1,000 CFA a year for the entire family.

The same situation is true of petty trade. While a few families are very active in trade, most practice no trade or only on a very small scale, with average benefit of a few hundred CFA a year.

It should be noted that when a small sample (78 families) was asked what they would do if they had a large sum of money at their disposal, 40% mentioned investing in cattle and livestock, 45% wanted to buy merchandise or cereals to trade.

Loans are available through the AVV for group or individual activities that benefit the AVV community. Much of the requests up to 1979 were for opening a store, a mill or a "pharmacy" at the village or cluster level. While these services are desired by many farmers, it is obvious that the number of possible stores are limited. Feasibility studies for loans will be easier to make if a detailed study is made over one year of a few farmers from AVV and neighboring villages who are successful traders, to ascertain which goods are derived, where they can be obtained and at what price, and the size and dispersion of the potential clientele.

Off-farm activities which produce scarce goods (such as vegetables, in many clusters) or which produce goods directly consumed or used by the producers (poultry, vegetables, weaving, agricultural tools, processed foods) should also be considered for promotion. The majority (about 90%) of the farmers surveyed in the sample of 78 families state that it is ready to contribute cash for some group activity, and most (79%) have done so before. either at the AVV or at the village of origin. However,

the system of loans proposed to AVV settlers will hamper the development of useful activities, since it stipulates that the loan must be repaid out of profits from that activity.

7.6 Food Requirements

The economic survey done in 1977-1978 included a preliminary research on food consumption. The data shows that AVV farmers normally eat only some sorghum or other cereal with a vegetable sauce which provides vitamins and other nutrients. The quantity of cereals consumed is less than the recommended amount in about 50% of the families surveyed. This is probably due to food shortage, because after the harvest, the amount consumed increases and becomes closer to the standard 2,230 calories per day (see I.3.3). This standard amount is used to calculate the surplus production per unit of labor, not the amount really consumed.

The number of family members who live permanently on the AVV farm is known from the yearly demographic census. On the average, the ratio labor index on total people is 1:2.2 for the families in the sample. One unit of labor must therefore produce enough food for 2.2 persons, each of whom requires 240 kg of sorghum and 30 kg of cowpeas (see II.3.3). Using the local market prices, this represents a cost of $(240 \times 62) + (30 \times 79) = 17,250$ francs CFA per person, or $17,250 \times 2.2 = 37,950$ CFA per family.

7.7 Surplus Production per Unit of Labor

Agriculture provides more than 90% of the income of an AVV farmer. In money terms most of the farmers in all the clusters, except Kaibo Sud, earn enough from agriculture to provide their family with the necessary food. Most of the income however is provided by the sale of cotton, and the cereal production was not sufficient for the AVV population (see part V-2-).

The AVV farmers will have to purchase most of their cereals on the local market, where the prices fluctuate in function of supply and demand (see V-2). If there is an important local shortage, prices can easily go over the average of 62 CFA/kg used for calculating the farmers' income. This will occur especially at the end of the dry season when the farmers with a cereal shortage rely completely on the market supplies.

PART V

SOCIO-ECONOMIC IMPACT OF THE AVV

Three goals had been set for the AVV: to relieve population pressure on the Mossi plateau, to maximize agricultural production of the Volta Valleys by introducing improved farming techniques, and to preserve the long term productivity of the area. In this section, the global results of the AVV will be assessed for each goal.

1. Demographic Impact

Upper Volta is more densely populated than other Sahelian countries except Senegal, and the population is unequally distributed, with densities ranging from 46 inhabitants per km² in the central part of the country to 9-10 inhabitants per km² in the east and northeast of the country. The population has been increasing at a rate of 2% a year, from 5,851,000 inhabitants in 1974 to an estimated 6,486,000 in 1979 (1975 National Census). Table 45 shows the estimated increase in rural population in some of the ORD's likely to provide migrants for the AVV villages.

TABLE 45

Estimated Population Increase in ORD's
Likely to Provide Migrants for the AVV

Year	Ouagadougou	Koudougou	Ouahigouya	Koupela
1975	909000	810000	563000	283000
1980	1001000	909000	610000	299000
1985	1104000	1022000	611000	318000
1990	1219000	1151000	716000	337000

These ORD are the most densely populated in the country, with 46.2 inhabitants per km² in Ouahigouya, 46.1 in Ouagadougou, 38.5 in Koupela and 32.1 in Koudougou. The ORD of Kaya is also densely populated, with 31.4 inhabitants per km². Because of heavy demographic pressure, there is not enough land available for cultivation, soil fertility is low, and fallow periods have been shortened. Migration, both foreign and internal, has been a traditional response to the lack of opportunity. Traditionally, migration to foreign countries involves around 7% of the population, mostly young unmarried men who leave either for several years or on a seasonal basis. Internal migration is also important, with menages moving to where land is available while still keeping close ties with their kin in their village of origin. Remy (OCP/73.1, VI-3, p. 4) estimates that 10,000 Mossi people migrated within the country in 1972.

Migration to AVV villages follows therefore a tradition. However, the rate of settlement organized by AVV is way behind schedule (see table 46); less than 2,000 families having been moved over seven years.

TABLE 46

Rate of Settlement Families Per Year

Year	1973	1974	1975	1976	1977	1978	1979	Total
Scheduled*	200	300	600	900	1,700	3,000- 5,000	3,000- 5,000	9,700- 13,700
Actually Settled	9	195	173	287	302	302	556	1,826

*according to Upper Volta Five-Year Plan 1972-1976, and 1977-1981.

The 14,000 people living in AVV villages in 1979 represent about 0.2% of the total population, or 2.2% of the total population increase from 1974 to 1979, or about 6% of the estimated population increase in the four most densely populated ORD's (see Table 45). During the 1974 to 1979 period, the number of migrants to foreign countries has increased by an additional 135,000 people from 309,000 to 446,000. The lag in settlement rate was tied at first to a lack of suitable candidates, but this was not true later on, when the AVV had become better known and the minimum requirements for a family to be settled had been lowered. Now small, young families without grown-up children are also settled by AVV. In later years, management problems have caused delays in identifying and preparing suitable plots for cultivation, or in opening the roads and building houses for the AVV field staff. In most cases, some settlers were brought in as scheduled anyway and the infrastructure completed in the following years. The number of people which can be resettled in AVV villages is small in relation to population increase and even if the original settlement schedule had been kept, the project could not have provided a significant solution for the population pressure.

2. Economic Impact of the AVV

2.1 Agricultural Production

About 90% of the AVV cotton production is marketed through the SOFITEX. Table 47 shows the total quantity sold, and the average per AVV family. Although this represents a small percentage of the total amount of cotton sold to the SOFITEX in Upper Volta (3% in 1978), it increases each year as the number of AVV families increases, and the quantity sold per ha is higher in AVV farms than the national average.

TABLE 47
Place of the AVV Production
in the Marketing of Cotton in Upper Volta

Year	1976	1977	1978	1979
Total Cotton sold, metric tons				
AVV	523	763	1890	2767
Upper Volta	55,000	38,000	58,000	NA
in kg/ha				
AVV	820	700	1280	1190
Upper Volta	745	725	NA	NA

NA: not available

The AVV participates in seed multiplication for the IRCT*, the first year at its seed multiplication center at Kaibo Sud, the second year at the agronomic station of Bane and the third year throughout all AVV farms. This is an advantage for the AVV farmers who received seeds of better quality than did farmers in the rest of the country.

Some local farmers, especially women, benefit also from the AVV emphasis on cotton production, as they are hired by the settlers for the harvest.

Table 48 shows the total cereal production of AVV settlers for 1977 and 1979, extrapolated from the survey described in Part IV. It should be remembered that most of the farms at AVV have not yet reached their full size. There has been little surplus production during that period, and it seems unrealistic to expect that the AVV fields will produce enough of a cereal surplus to provide food for a significant number of families. Most of the surplus production at the farm level is kept in stock for future use should the crop fail. Until now only small quantities are marketed on local markets.

Crops like cowpeas, peanuts and soybeans are produced in very small quantities for they are not cultivated on a larger scale than on the traditional farms. Traditionally, they would be cultivated in mixed cropping with the sorghum, a practice not allowed by the AVV extension, except in the house garden.

*IRCT: Institut de Recherche du Coton et des Textiles Exotiques.

TABLE 48

Surplus Production of Cereals Since 1977 at the AVV (extrapolation from sample)

Year	Number of Families	Total Population	Area in Cereals*	Average yield kg/ha	Total Production	Total Consumption Ton	Difference Ton	AVV Production per capita	National Production per capita
1977	905	6,100	2,260	780	1,760	1,464	+296	289	189
1978	1,200	9,000	3,050	670	2,040	2,160	-120	227	195
1979	1,700	14,000	5,300	470	2,491	3,360	-869	178	202

* in ha, including house compound.

2.2 Marketing

The cotton is marketed mainly through SOFITEX. In some villages AVV together with the village committee organized a cereal stock so that farmers who contribute to the stock are assured they will be able to borrow cereals or buy them at cost (purchase + storage cost) should their crop fail. Otherwise, the AVV settlers rely on the existing local market in the neighborhood but often create their own market as well.

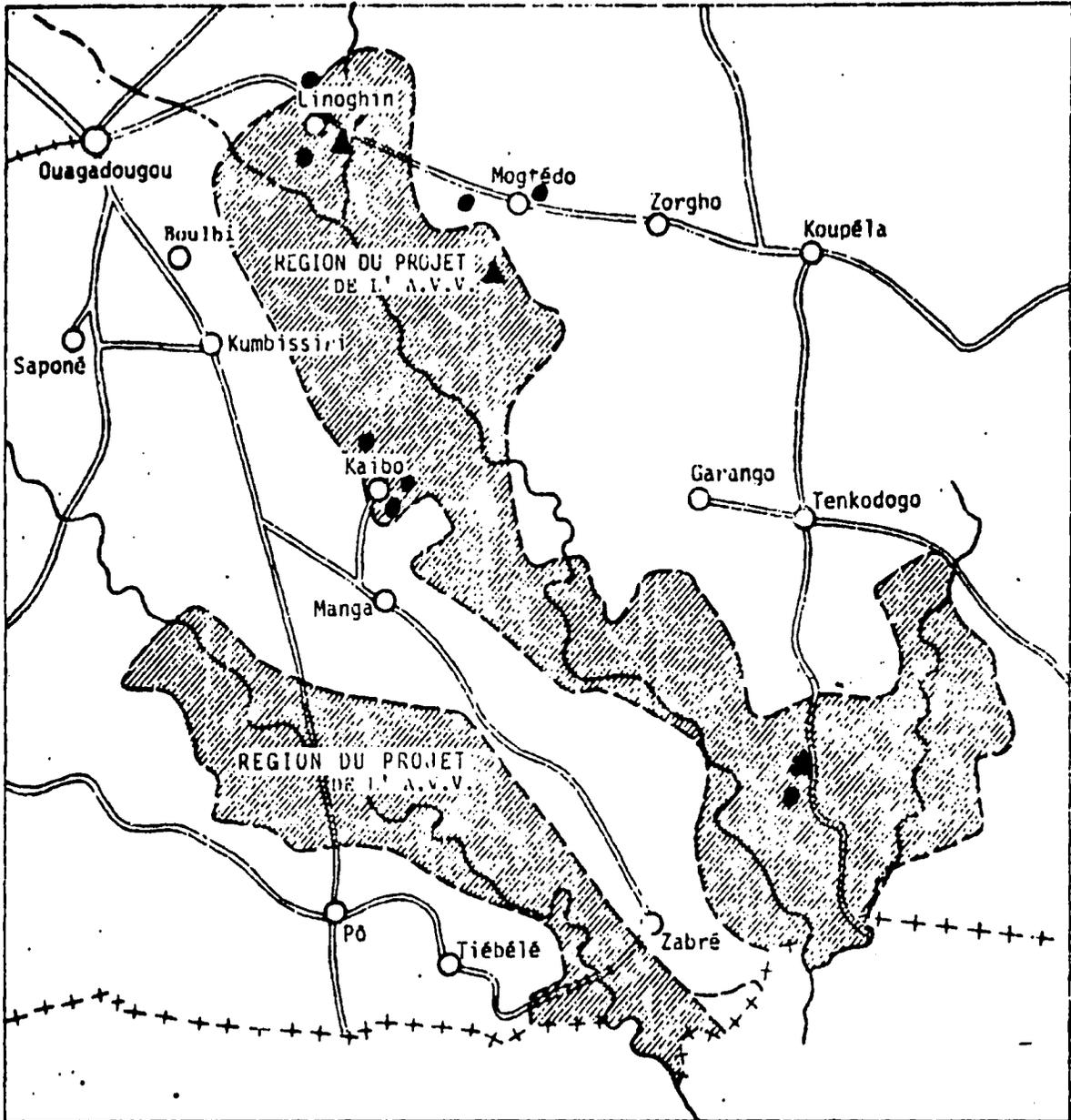
Marketing of cereals in considerable quantities can have implications on the functioning of the local market, especially a small, isolated local market where the supply of cereals is very limited. The production of local farms is in general barely sufficient to provide enough food for the family for the whole year. Farmers sell small quantities of cereals on the local market only when they need cash. A large surplus, as was planned in the AVV program, will lead to a drop in prices on the local market. Bigger markets, (and those of easy access) suffer less from this effect because merchants do come to buy cereals in large quantities at a time, although often below the retail price, if there is a sufficient supply.

In almost every cluster of AVV villages, the settlers start a new market, although they also regularly visit the local markets in the area. In two cases (Linoghin and Bane) those markets have rapidly expanded and now play a significant role in the local system. This is mainly due to the fact that both markets are situated next to a tarred road and are easy for the merchants to reach. In addition, when the market is big enough to be noticed, people heading for the capital stop to get cheap supply, since local prices are lower than the prices in the capital.

During two years the prices of the most important agricultural products were monitored on local markets in the neighborhood of the AVV clusters of villages and on newly created markets in the AVV area (see Map 4). The price data were gathered by dish, the uniformly used local measure. Every now and then one measure of product was bought for weighing. Since the same unit of measurement was used everywhere, the weight could be easily determined while fluctuations in weight were only due to uncontrollable errors (humidity, measuring errors, quality of the grains and the way of filling the dish). Throughout the year, every third market (every twelve days) was visited to gather the price information.

Prices do not vary only from one market to the next but also within the market during the day. The survey could not gather data in such detail but does give a general indication of the price fluctuation. The markets monitored can be subdivided into two groups, according to size and ease of access. In the small isolated markets the prices are determined by local surplus or shortages while there is only little influence from outside the market. The quantities marketed are always very small. In the markets easier to reach, and usually bigger, the prices are less dependent of the local situation and there are more possibilities to market products in big quantities.

In Annex IV the average price fluctuation (in CFA/kg) of those two groups of markets are shown for sorghum (red and white) and rice (paddy



après 'Les atlas jeune africain'

Map 4 Location of markets studied.
● local markets
▲ AVV markets

and hulled). It shows clearly that the small isolated markets have a lower price level than the larger, easily reached markets.

For the more common products, which are produced by the farmers themselves (cereals, legume crops, etc.), this is a normal situation. The price difference between the markets represents the costs of transportation of the products by the farmers in the larger markets, where merchants buy to resell in the main consumption areas (Ouagadougou and other main cities).

Rice is an exception, because little is cultivated in the area. High transportation costs to the small markets make it more expensive there. The quantity sold, however, is very small.

The price trends are represented by the 12 monthly moving average. Data over two years are not sufficient to show any trend in prices, considering the large margin of error in the data gathering. It should be noted, however, that the moving average price of white sorghum, which is the staple crop, is very stable at around 60 CFA per kg. This is much higher than the official price of 40 CFA per kg to the producer.

The other crops monitored (maize, cowpeas, peanuts, etc.) were not always available on the market. It is therefore not possible to show the yearly fluctuations for those crops.

2.3 Infrastructure

The AVV project provides more permanent results than only the settlement of the farmers. Before the implementation of a village the AVV does an intensive soil and hydrological survey to locate the fields and wells. Those surveys, done systematically for the whole area of the AVV, create a documentation which is essential for the Upper Volta's development planning.

The AVV also builds roads connecting AVV villages to the national network which are opened to local traffic. However, the benefits would be greater if the roads were designed as an integral part of the regional planning, rather than for AVV use. For the moment, it is frequent that a road built by AVV is used strictly by the expatriate experts and AVV employees based in Ouaga and travelling by car, and this mostly during the wet season; the local farmers, the AVV farmers and the AVV field agents who travel on foot, bicycle or mopeds using unimproved or slightly improved traditional paths which are shorter and serve local villages and markets, and this even between AVV villages. In 1979, the European Development Fund financed the creation of the bloc of Mogtedo Bambore (250 families settled in 6 villages). Road construction has cost them 3 million CFA per km for main roads, which were traced so that each village is at about the same distance from the main AVV road. Tracks are now being made at a cost of 40,000 CFA per km to join two villages through their fields, and some are already used more heavily than the main road because they are more direct.

The extension service, very intensive in the beginning, employs extension workers who are trained during a yearly training session as

well as on the job. This will provide in the near future, when the job of AVV is finished, a great number of trained extension agents who can be employed in the ORD's throughout the country.

The AVV also provides additional training to many of their employees, and the experience acquired at the Agricultural Credit Section could be used as a model for developing similar facilities in the rest of the country.

3. Social impact of the AVV

3.1 Regional impact

The areas close to the Volta Valley are underpopulated but they have never been empty, even though there is evidence of great fluctuations in land occupancy. Two categories of people have traditional rights of use in the Volta Valleys: Fulani transhumants and farmers. More recently, spontaneous migrants (that is farmers who come on their own to open a new farm), have been moving in increasing numbers into the AVV territory.

Much of the more sparsely populated areas now controlled by AVV has been traditionally used by Fulani herders, especially during the dry season. Conflicts arise with AVV settlers when a Fulani herd damages a field or messes up the surroundings of the wells in a village.

There have been permanent villages in the area for generations, mostly Mossi, with some Bissa and Kassena people in the southern areas and Daguari in the west. The villagers cultivate some permanent fields close to the village and practice shifting cultivation in bush fields. While the village chiefs have political authority over the inhabitants, land rights are attributed under the chiefs of the land, descendants of the first occupants in each territory. Each lineage thus controls the right of use over a territory larger than what it can cultivate in any given year. Whatever land is not needed for cultivation by the families settle in the local villages can be (temporarily) attributed to strangers.

When the AVV was created the government of Upper Volta decided that all land within AVV perimeters not under cultivation in 1972 (as seen on aerial photographs) was therefore unoccupied and became government property. The traditional rights of the local population on land not under cultivation were ignored.

Local villages who have lost access to some of their fallow land have usually opened other, illegal plots on their traditional land very close to AVV fields. In every cluster except Bombore there are traditional fields at the periphery of AVV fields. The AVV settlers who occupy the land without having received the approval of the local chief of the land are trespassers in the traditional system. Therefore an important group of AVV farmers have chosen to contact the chief of the land outside of the AVV administration and to perform the traditional rituals on their field. In this way, both the local people and the settlers feel reassured about the legitimacy of their fields.

In recent years many individual families or ménages migrated on their own to settle on or around the AVV area and obtained the right to

farm unexploited land from the local chief of the land. There is evidence that this movement has been increasing in the last few years, partly because it has become known that the risk of onchocerciasis has been reduced and partly because the AVV is showing the way by providing villages and infrastructure, as Voltaic people are reluctant to live in isolation in the bush.

It is not known how many spontaneous migrants were present on AVV territory in 1979. The data included in Table 49 are estimates provided by the Sociology Division of the AVV.

TABLE 49

Number of Spontaneous Migrant Families Farming
Near AVV Villages

Bloc	AVV Families	Spontaneous Migrants Families
Linoghin	252	250
Mogtedo	176	? at least 3 groups
Bambore	273	200 (many Fulanis)
Kaibo Nord	145	? many local farmers (more than 250 families very close by in two villages)
Kaibo Sud	188	at least 150 ?
Manga Est	100	98
Tiebele	164	? (many, relatively more than in other blocs)
Djipologo	231	

It is clear that people are coming in increasing numbers to farm unused land in AVV territory. Often, they keep their residence in their village of origin (anywhere up to 200 km away in an area recently studied) and set up temporary quarters in an AVV area during the agricultural season. In fact, spontaneous migration is progressing ahead of the AVV settlement effort. Until about 1977, the AVV had simply requested that these people join the AVV or move away, which was easy to do when there were very few of them. The government at the time also condemned the practice of spontaneous migration into AVV land, to no effect.

In 1977, some spontaneous migrants had joined the Farmer's Union and there had been a series of meetings between the AVV and the Union. The strategy chosen has been an attempt to convince the spontaneous farmer to join the AVV (which means leaving his home to come live permanently in the AVV village) or to abandon the land. For the area of Rapadama, where an important spontaneous migration had preceded the opening of the AVV villages in 1980, the AVV has made a great effort to inform the migrants and the local authorities, and about 300 of the spontaneous migrants have agreed to join the AVV. They have been given priority over candidates from more distant areas.

In theory, local farmers can ask for technical information from the AVV extension agents, but nothing is done to inform and encourage them to do so. Yet, if the AVV villages were conceived as a center of diffusion of improved agricultural practices and other benefits for the regional economy, rather than being strictly limited to a small target population, it would be easier to justify the cost of the infrastructure and of the administration.

3.2 Impact on the settlers and their family.

Traditionally, migration does not curtail social obligations between the ménage and the extended family that remains in the village. AVV settlers do keep close ties with their family, so some AVV benefits are spread to the villages of origin. After the 1978 harvest (a good crop year) about 80% of the settlers visited their family back home, bringing gifts. Cash is by far the most frequent gift (87%), followed by cereals (34%), cotton (27%), and livestock (18%). Of those who travelled, 55% also bought something for their AVV compound, most often a radio, a bicycle or livestock.

It is indeed very important for ménages to keep close ties with their extended family, since they will have to rely on them for assistance in case of illness or crop failure. The AVV ménages can be faced with conflicting obligations; the cotton harvest takes place after traditional crops have been harvested, at a time when ceremonies are often held in the traditional villages. This was especially true in 1979 when late rains delayed the cotton harvest. Some settlers chose to keep part of the ménage at AVV to finish harvesting while one or two members were sent to the village of origin, a few left some cotton unpicked.

Group activities and social obligations are becoming more frequent within the AVV villages but this should not be expected to decrease the desire for frequent visits back home. It is clear that some settlers consider their stay at AVV to be temporary. In a survey on a small sample of older settlers, 72% said if they had the money they would build a better house, but 17% of these volunteered the information that the house would be built "back home," 14% specified they would build it in the AVV village, and 59% did not specify a location.

Many heads of household explain that they have a larger disposable income than at the village of origin because they control the entire crop production, a privilege that back home belonged to the head of the extended family. This enables many of them to assume expenses for animal traction and agricultural tools, livestock, and consumption goods (radio, bicycle) that were previously beyond their means.

3.3 The Place of Women at the AVV

The AVV administration deals directly with the male head of household (chef d'exploitation) who receives the right of use of all the land allocated to the family and is responsible for the credit taken with AVV.

This has had at first a negative effect on women's personal income, which traditionally derives from cultivating their own fields and participating in petty trade.

Later on, the AVV suggested to the head of household that he put aside .2 ha of his house garden for each wife. This was an unusual intrusion of an outside authority into the compound's structure. Unknown to the administration, women are now often being given responsibility by their husband for the part of the bush field which is cultivated with cowpeas. This is a more traditional way to redistribute land within the household, and it should be taken into account by the AVV extension agents. Cowpeas have an important role in the AVV crop rotation but they are not cultivated as much and as often as they should be. The extension effort would be more efficient if it were directed to the women who cultivate that crop.

McMillan (1980) has found that some AVV women are also opening additional sorghum fields in the bush, outside of AVV plots. McMillan points out that the women complain more because of lack of time and outlet for trade and off-farm production than because of lack of private fields. AVV women have sources of income which did not exist traditionally. They receive cash and cotton from their husbands after the cotton harvest is sold, and they also receive gifts of food (mostly maize) from neighboring heads of household after the first food harvest of the year, as social obligations are being created between AVV families. In addition, at AVV the head of household often pays for items such as clothing which before would have been paid for by individual members of the family, so women need less cash for basic necessities.

4. Discussion of costs and benefits

The AVV is a large project which receives greater financial support than the ORD's although its target population is much smaller. The 1971 FAC project (French) planned for the settlement of 120,000 people in the White and Red Volta over 15 years at a cost of about \$50 million. By the end of 1976, about \$9.5 million (2,396 million CFA) had been received (cited in 1977-8! Five-Year Plan). A budget of \$7.5 (1,870 million CFA) was planned for 1977, \$13.5 (2,500 million CFA) for 1978. A report prepared in 1978 for the donor countries estimated the cost of settling one family at \$12,500, including some \$3,710 for roads and \$1,800 for mechanical preparation of new fields (BEI-Agrer report, see Table 50).

TABLE 50

Cost to the AVV of Settling One Fa
According to the BEI-Agrer Report

(February 1978)

	CFA	%	%
1. Preliminary studies			
- pedology 1/20,000 (40,000 ha a year)	30,800	1.18)	
- geohydrology 1/20,000 (40,000 ha a year)	45,000	1.72)	2.90
2. Settling the farmers			
- recruiting and moving	50,000	1.94)	
- transportation WFP food	19,900	0.76)	
- marking location of villages and fields	61,425	2.35)	5.13
- preparing master plan for bloc	2,000	0.07)	
3. Infrastructure Total 37,67			
- roads	557,000	19.36)	
equipment and personnel	139,900	5.35)	26.46
technical asistance	45,700	1.75)	
- housing	187,600	7.17)	
equipment and personnel	23,000	0.88)	8.05
- wells	81,600	3.12)	
4. Land preparation			
land clearing 53,000)			
deep plowing 212,100)	368,700	14.10	
harrowing 103,600)			
5. Equipment and supplies	40,700	1.55	
6. Field personnel for 3 years	138,000	5.27	
7. Update cars and furniture	34,200	1.31	
8. General expenses AVV	491,700	18.80	
9. Technical assistance (10 experts for 3 years)	<u>297,000</u>	11.36	
Total	2,615,125		
	(about \$12,500)		

As an experiment, the six villages created in 1980 in Rapadama (Dutch funding) received a light infrastructure consisting of a high grade road leading to a central warehouse; the villages are connected only by tracks; huts rather than houses are built for most of the AVV employees during the first year. After the farmers themselves have cleared the land, the AVV provides a light mechanical plowing. There will be one extension agent for 50 rather than 25 families. An effort will be made to encourage participation of the settlers in decision making and group activities. Because the majority of Rapadama settlers had already moved to the area on their own, this experiment will help determine how the AVV should modify its action so that it can fulfill its most important task: to promote permanent cultivation while preserving soil fertility.

The AVV has large administration, which must handle at the same time preliminary studies for future villages (including drawing maps and locating water points), recruitment and settlement of new farmers, implementation of extension services for older settlers, road and housing construction, and maintenance and repair of heavy equipment and vehicles. In addition, it must provide technical training for many of its employees. It is administered by a board of directors chaired by the Minister of

Plan and including 17 Government administrators. The General Director of the AVV is appointed by decree by the Cabinet. The headquarters are divided into 5 directorates (General, Finance and Administration, Plan, Construction Work and Agricultural Development). At the end of 1979, when about 1700 families lived in AVV villages, the AVV employed 650 permanent and 400 short term Voltaic employees, 20 Voltaic technicians and 38 expatriate technical experts.

The administrative structure is heavy and highly centralized, with little horizontal communication between Directorates. Communication with field personnel is difficult (no phone, long distances, difficult roads) and is hampered by the administrative centralization. There have been frequent delays in actions (i.e. opening of new fields, completion of infrastructure, needed maintenance of equipment) for which the settlers have carried the burden, since the AVV brings the settlers to a new site even if it is obvious that it will not be ready on time, and since older settlers depend upon the AVV action before they can sow their new field for the year. In 1979, in the bloc of Kaibo Nord, the sorghum crop was planted 6 weeks late because of such delays and the harvest was very poor with yields at or below the traditional level. Delays have also occurred, in maintenance or response to unusual situations at the village level.

It is clear that if the number of families settled each year is to increase, then a shift towards a lighter infrastructure and a more flexible administration is needed. Recently, the leaders of AVV have recognized that the actual administrative structure can hamper efficiency and are discussing various means to alleviate the problem; a multidisciplinary group of experts has been nominated to coordinate and plan the AVV activities in the future.

PART VI

CONCLUSIONS

The government of Upper Volta has created the Volta Valley Authority (AVV) to organize the settlement and agricultural development of the Volta valleys recently freed of onchocerciasis. The years 1973 to 1977 were planned as an experimental phase in designing the settlement program and in defining the technical package that would be promoted. During that period many difficulties have occurred in defining adequate farming practices and extension approach, and the pattern of land use around AVV villages has changed. It is therefore crucial to evaluate the results achieved and to reconsider the goals and strategies of the AVV.

1 Technical Package and Extension Service

1.1 Agricultural Production

The cotton yields are quite good, but the cereal yields are very erratic and in 1979 were often below traditional levels. The yields at the farm level vary rather much from one farmer to another. Even the effect of early planting, which is extremely important under the climatic conditions of Upper Volta, is nullified by other factors, especially delays in weeding. Many crops were hampered in their development by striga or waterlogging (especially on the heavy soils). Insect and animal damage (both wild and domestic) accounted for an important part of the crop losses. The brush fires at the end of the crop season especially threaten the cotton fields because they are harvested at the time when traditional farmers start burning their fields.

1.2 Crop Rotation and Land Use

The crop rotation now recommended by AVV is not being respected, partly because it has been changed several times over the years. It is clear that the farmers are emphasizing cereal production, that legumes are often not cultivated at all, and that about 15% of the fields are being cultivated during the fallow period (years 5 and 6). This, combined with the fact that the farmers use very little if any fertilizer on their cereals, is likely to bring a rapid decrease in soil fertility.

1.3 Tillage

The AVV uses heavy equipment to plow the fields distributed to AVV farmers. In the second year of production those fields are plowed by the farmers themselves with their oxen while often the farmers do not plow at all. The crop yields do not seem to be influenced significantly by the way the land is tilled. Since there is not yet a consensus about the effect of tillage practices (Phillips, 1980), AVV should consider replacing this expensive mechanical deep plowing by a cheaper method or maybe only clearing of the land. The farmer on the other hand should be advised to do only a light harrowing instead of plowing, as it goes much faster and makes it possible to plant early.

1.4 Inputs and Crop Maintenance

The level of fertilizer recommended by the AVV to maintain fertility (150 kg NPK of 14:23:14 mixture per hectare) is rarely applied. Fertilizer (and insecticide) use is frequent on the cotton fields, but the white sorghum fields receive little or none, and the use of fertilizer on other crops is very rare. The fertilizer does not seem to have any significant direct effect on the crop yields. The long term effect of this low fertilizer application on the preservation of soil fertility cannot yet be evaluated.

The farmers are usually limiting their crop maintenance to one weeding. This is due to lack of time, partly because of a labor bottleneck in plowing and sowing activities, and partly because other activities (social obligations and visits) are given priority. The farmers are not convinced of the potential return of intensive versus extensive cultivation of improved varieties and therefore are not willing to cut down on other activities.

1.5. Use of Animal Traction

During the first years after buying a pair of oxen and the equipment, the farmers do not use animal traction to its fullest potential, and they spend less than planned on the upkeep of their oxen and maintenance of the equipment. The introduction of animal traction in traditional farming is always a long drawn out process and is costly to the farmer. It can be facilitated if the oxen are carefully selected and if continuous training is given to the farmers and to the extension agents during the first few years. A positive impact from the use of animal traction on the farm results should not be expected during those years of training, as was shown in other projects in Upper Volta and elsewhere. Farmers who are equipped with animal traction are not able to cultivate more land per unit of labor or to achieve higher yields per hectare because of better land preparation or weeding practices. However, older settlers do use their oxen more and more, including in their house garden.

1.6 Agricultural Income of AVV Families

The gross agricultural results at the farm level are within or over provisions. This is due partly to the fact that on the average the farms are larger than they should be. The farmer always prefers to plant as much as possible, and the size of the labor force has been increasing faster than the planned increase in farm size over the years.

This is a sign of success for the AVV; the head of household calls for additional workers from back home when he feels confident that his farm can sustain them. AVV benefits are thus spread to a larger population; the villages of origin benefitting indirectly by having a farming outlet for underemployed individuals, and by receiving gifts from the AVV settlers.

The income of AVV settlers derives primarily from farming, with cotton providing most of the cash income and about half of the net value of the farm production. For the 1979 crop season, the net income per unit of labor was around 50,000 to 70,000 CFA in most clusters, generally equal to the 1978 crop season except in Bane where the farmers had had an exceptionally high income in 1978. In Kaibo Sud the 1979 income was rather low because of the complete failure of the sorghum; the average agricultural income per capita was 23,000 to 32,000 CFA. Except in Kaibo Sud, most farmers earned enough to meet their food requirements.

1.7 Impact of the Extension Program

The AVV settlers are exposed to an extremely intensive extension service (one agent per 25 families for the first five years) but the technical package promoted by AVV is too complex to be adopted all at once by the settlers. Furthermore, most of the extension agents are young people with no experience and little training in farming, they live away from their family, and many are not married. In the traditional, strongly hierarchical society, they have a social status lower than that of the farmer, who is also a head of household. Yet their employment with AVV places them in a position of administrative authority over the farmers. This is an extremely ambivalent situation.

AVV concentrates its effort on the promotion of cotton and its related technical package, compromising on the other aspects of the technical package. The result of this concentration of effort is that the farmer has adopted fully the following techniques:

- Monocropping
- Use of AVV seed variety for all crops
- Chemical protection of seeds and stored grain
- Sowing in rows
- Cultivation of cotton on the areas prescribed by AVV
- Use of the recommended quantity of fertilizer on the cotton
- Thinning
- Correct weeding of the cotton
- Use of insecticides on the cotton

Such a concentration on the cotton production implies that some important aspects of the technical package are poorly applied:

- Fertilizer use on other crops but cotton, since it is not done traditionally.
- Correct rotation, which together with the fertilizer is essential for the maintenance of soil fertility.
- Cultivation of legume crops, an essential element of the rotation, is neglected, because AVV prescribes more legumes than the farmer wants to grow. Therefore AVV should look for alternatives which can replace the legume crops and are acceptable to the farmers, or should allow intercropping of cowpeas and sorghum.
- Correct crop maintenance: The farmer weeds most crops too late and only once, while he does not ridge at all, except for cotton. Traditionally extensive farming is always a better answer to the climatic risk and uncertainty than intensive farming. The AVV experience is

showing the same thing, so the settlers plant as much as possible and therefore weeding is often too late.

- Use of animal traction: This is always a long drawn process which requires extension agents familiar with training oxen and the use of animal traction, so they can truly help the farmers.

1.8 Recommendations

It is now clear that an important part of the technical package is being adopted by the settlers when their activities are kept under strict control by the extension agents.

The technical package now emphasizes an intensive, costly approach to cultivation of food crops which is directly in conflict with the traditional farming system. It is unrealistic to expect that the farmers will take the risk of drastically modifying their farming techniques over a few years to adopt an approach which brings them no clearly demonstrated benefit. Preference should be given to a more extensive low capital farming system of food crop production, with more diversified sources of income in addition to agriculture.

The technical package should be simplified to emphasize only a few key points which can be effective regardless of whether the remaining elements are performed, and which are repeated over the years only as needed.

Forage crops should be promoted during fallow periods, if they can be protected from Fulani herds, and the crop rotation should not depend as much on legumes. Intercropping with legumes (cowpeas) should be considered. Erosion control and soil conservation measures that are not too costly should be emphasized (research is under way at Mogtedo in an AVV-ICRISAT-USAID project) and tillage should be kept at a minimum. For example, on any given year the plot to be cultivated with cotton could be plowed with ox traction while the other plots are only harrowed. This would help ensure timely planting and weeding of the crop.

2 Impact of AVV on the Settlers

2.1 Income of the Settlers

The average gross agricultural income per unit of labor has been quite stable over the last three years except for Bane, which had extremely good results in 1978, and Kaibo Sud, where the sorghum failed completely in 1979. The gross income is not expanding over the years as AVV had planned, mainly because the family grows as fast as the land allocated to it.

Off-farm activities other than small livestock are curtailed after the settlers arrived at AVV by lack of cash and lack of time, but there is a strong desire among the settlers for diversification of their activities. The Village Development Fund, which provides loans to individuals or groups who want to develop an activity useful to the community, is being welcomed by the farmers, although the requirement that the loan be repaid out of benefits from the activity, rather than through group contributions, limits its usefulness.

2.2 Land rights

The problem of land availability for new generations is already arising in some blocs. Each plot assigned to a family measures 1.5 ha, and the family is told how much of that acreage to put under cultivation, depending upon the size of its labor force. If the labor index is over 5.75, the amount of land put aside for that family is doubled, and it receives two house gardens. At the village level, the total amount of land which will ever be cultivated is established by the AVV at the onset. If the size of the labor force increases in many families, a time comes when no more land is available to double any holdings. An expanding family will have to split up, with one ménage going to settle in another AVV village.

In a traditional system, an expanding family could borrow land; this is sometimes unofficially done at AVV but few families have much land to spare. In an area with a low population density, as is true of AVV land, an expanding family could also open new fields in the bush; this is not allowed by the AVV. Farmers are expressing concern over this built-in inflexibility, and are also wondering what their children's situation will be at the death of the head of the household. When this has occurred, the farm was kept by the family when a married son or relative could take over as head of household. Otherwise the farm was returned to AVV to be attributed to a new settler.

These problems are tied to the ambiguity of land ownership in AVV territory. Traditional land use rights, in which a lineage controls the right of use of its territory, are still prevalent in much of Upper Volta. When the AVV was created, the government of Upper Volta decreed that the land within AVV perimeters that was not cultivated in 1972 (as seen on aerial photographs) was unoccupied and therefore became government property. At this stage, it is not clear what the government intends to do about eventual land ownership by the settlers. In the meanwhile it is clear that many farmers are not convinced that their stay at AVV will be permanent. Even after four or five years, many have built only minimal houses at the AVV village, although they have often invested in better quality housing in their village of origin.

2.3 Women and Unmarried Adults in the AVV

Women do lose their traditional individual fields when they come to the AVV, but informal means of compensating the loss are being established in the older villages. It is likely that the AVV will have a more useful influence if it refrains from trying to administer resources allocation within the family but directs more of its extension effort towards the women, who are usually in charge of cowpea and peanut production.

Young adults also lose their traditional individual fields. In many villages the traditional youth groups have been recreated, the young people earning cash by working on their neighbors' fields and on their own communal field. However, this is not sufficient to curb the external migration rate among the young unmarried sons of the AVV settlers.

2.4 Social Programs

The settlers appreciate the availability of schools and dispensaries and there has been little difficulty in organizing group activities such as building a delivery hut in each cluster, although the location of the cluster's mill has been a more difficult choice. The AVV has made an effort in the last few years to promote group activities and to provide programs in adult education for the settlers. In many villages, various forms of mutual aid and group labor are being spontaneously reorganized along traditional lines, although they often coincide with people coming from the same area of origin.

3. National and Regional Impact of AVV

In order to fulfill its settlement program, the AVV has had to conduct preliminary studies identifying suitable village and field sites, thus putting together a body of morpho-pedological, hydrogeological and topographical data that will be useful for regional planning.

Agronomic experimentation is being carried out in four locations. The AVV has also been providing technical training to its employees in numerous fields, including soil surveys, well drilling, road and building construction, accounting, agricultural extension, data gathering, agricultural experimentation, veterinary care, and more. This is an important benefit for the country since there is a great need for trained people.

The impacts that had been foreseen at the national level--to relieve population pressure on the Mossi Plateau, to provide a cereal surplus for the country--were overly ambitious. Considering the rate of increase of population of the Mossi Plateau, the AVV could not take care of more than a small proportion of the increase in a settlement scheme. There is an agricultural surplus coming from the AVV but it is mainly in the form of cotton. There is no great incentive for the farmers to grow food grain as a cash crop as long as the marketing possibilities remain very limited.

Another discrepancy between expectation and reality is the land occupation of AVV areas. These areas were more extensively cultivated than was believed, and they were used by Fulani herders. In addition, individual migration towards the Volta valleys is rapidly developing.

The AVV still might be able to fulfill its goal of promoting agricultural development while preserving the fertility and ecological balance of the area, but it can only do so if a drastic change in strategy is accepted. One does not preserve the ecological balance of an area by working only on scattered villages and fields with a small percentage of the population. It is crucial that the AVV attempt to reach the local farmers and the spontaneous migrants as well as the settlers. This can be practical only if a more extensive approach to farming is promoted, one that will protect soil fertility without requiring too large an investment on the part of the farmer.

Until now, the AVV has been limiting its services to the farmers who accepted to live in an AVV village. A farmer who refuses to move from his own family home 2 or 3 miles away will not have access to the AVV program even though he may have fields contiguous with AVV fields. The question of land ownership is also basic to the relationship between AVV and the local farmers, the spontaneous migrants, and the Fulani herders, although this is an issue which will have to be dealt with at the national level rather than by the AVV itself.

In choosing a highly controlled, capital intensive approach to the settlement of the Volta valleys, the government of Upper Volta was taking the risk of concentrating much of its material and human resources to obtain a small result on a very limited population; the problems met by the AVV are not surprising and do not reflect the great amount of work and dedication which has been provided by AVV administrators, staff and technicians.

This type of large scale, centralized development institution always faces great logistical and management difficulties and ends up being very costly. Much has been accomplished in spite of the difficulties, but the effort can be justified only if it is spread over the whole population of the area, by promoting a more simple approach to soil conservation and agricultural extension, and by emphasizing regional planning and development.

The case of the AVV demonstrates once again that we need to learn much more about traditional farming systems and about the results that can be expected from new farming techniques in real farming conditions before we can recommend specific programs for agronomic experimentation and for agricultural extension services in developing countries.

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**NET 1 - RAIN FIGURES FOR THE
1979 CROP SEASON**

MONTH :-	DECADE	RAIN FIGURES IN mm AND NUMBER OF DAYS PER DECADE PER CLUSTER OF VILLAGES											
		LINOCHIN		MONTADO		BAMBORE		BANE		KAIBO NORD		KAIBO SUD	
		mm	days	mm	days	mm	days	mm	days	mm	days	mm	days
MAY	1	20.7	1	90	1	78.6	1	72.2	2	36	2	42.4	2
	2	10.3	1	56	1	8.8	2	4.2	1	14	1	7.1	1
	3	64.3	3	51.7	4	16.4	5	43.7	4	25.8	3	25.6	2
JUNE	1	20.8	2	32.2	4	33.3	3	72.3	3	45.1	4	46	3
	2	27	2	26.6	4	24.4	6	40.7	4	35.9	4	58.1	5
	3	40.4	4	6.5	3	21	3	16.8	2	21.2	2	4.2	2
JULY	1	47.6	3	39.4	3	40.5	5	29.8	2	45.6	2	51.8	5
	2	20.6	3	50.3	4	64.4	5	100.7	5	59	4	80.2	4
	3	78.2	5	60.9	5	87.4	5	57.1	4	88.6	5	112.4	6
AUGUST	1	97.4	3	62.0	2	75.5	2	67.0	3	79.0	3	85.7	4
	2	35.4	2	39.9	5	70.2	5	53.3	4	39.5	5	76.8	4
	3	137.5	6	91.3	7	64.5	6	112.5	7	75.6	9	123.5	8
SEPTEMBER	1	123.4	5	124.5	6	138	6	58.3	4	99.5	4	93.0	5
	2	50.6	3	21.6	4	1.2	2	57.9	3	-	-	13.2	2
	3	34.3	1	41.4	3	42.0	2	24.6	2	75.0	4	59.5	4
OCTOBER	1	28.5	2	8.1	1	6.5	2	28.1	1	14.0	2	4.0	1
	2	4.9	1	9.0	1	24.8	4	7.6	1	8.5	1	38.5	3
	3	21.4	2	-	-	-	-	25.4	2	11.0	1	10.8	1
NOVEMBER	1	47.5	1	18.0	1	15.0	1	-	-	-	-	-	-
	2	-	-	-	-	-	-	-	-	-	-	-	-
	3	4.0	1	-	-	-	-	-	-	-	-	-	-
TOTAL 1979		914.8	51	829.4	59	812.5	65	872.2	54	772.3	56	932.8	62
TOTAL 1978		539.5	42	702.3	49	-	-	686.2	51	748.5	57	854.3	51

Annex II

Survey forms

- 1 Population Census
- 2a Questionnaire, farm survey 1978 first part (once a week)
- 2b Questionnaire, farm survey 1978 second part (once a week)
- 3 Recapitulative form of labor survey 1978 (enumerator)
- 4 Estimation of crop production 197^a
- 5 House garden production 1978
- 6 Market survey 1978
- 7 Recapitulative form of labor survey 1978 (for microcomputer)
- 8 Recapitulative form at farm level 1977 to 1979
- 9 Questionnaire, farm survey 1979
- 10 Estimation of crop production 1979
- 11 House garden production 1979
- 12 Market survey 1979 - 1980
- 13 Recapitulative form for 1979 crop production (for microcomputer)
- 14 Questionnaire, farm survey 1980
- 15 Estimation of crop production 1980

ne pas remplir :

SUIVI ECONOMIQUE

1	2	3	4	5	6

Nom du CE

Date de remplissage

N° d'exploitation

Table 10 : CONSOMMATION DE LA FAMILLE (au jour du remplissage)

Jour	Mois	année
18	9	1961

Bloc	village	parcelle
13	14	15

Céréales (par exemple : sorgho, mil, maïs, fonio, etc ...)

Nature	Quantité (unité locale)	Nombre de personnes ayant mangé	Origine				Observations
			Stock	marché local	marché A77	autres	

TABLE 60. MOUVEMENTS DE CEREALES (récapitulatif des derniers sept jours)

Nature	Quantité (unité locale)	Prix si acheté F. CPA	Donné en cadeau	Reçu en cadeau	échangé	Observations (par exemple nature de l'échange)

TABLE 70. SITUATION FAMILIALE.

Nom	Période	Absent	Visiteur	Si malade nature maladie	A travaillé	Observations

40 - ANIMAUX OBTENUS

boeufs*		Nombre				Prix C.F.A.	Source					Observations	
M	F	mouton	chèvres	vol. ailx	autres		marché local	marché A.V.V	magasin A.V.V	maï- sence	cadeau		rembour- sement

Table 41. Animaux et produits animaux sortis de la ferme

boeufs*		Nombre (quantité)						Prix C.F.A.	Destination					Observations	
M	F	mouton	chèvres	vol. ailx	autres ani.	oeufs	lait		marché local	marché A.V.V	cadeau	rembour- sement	perte		consom- mation

Table 42. Dépenses pour les animaux (y compris toute la nourriture donnée qu'elle soit du stock ou de brousse).

Nature	quan. unité locale	Source					Prix C.F.A.	Destination					Observations		
		marché local	marché A.V.V	мага. A.V.V	Stock	autres		boeufs attel.	boeufs	mouton	chèvres	volailles		autres	

*Marquer en observation l'âge approximatif (en année) des boeufs obtenus ou sortis de la ferme.

AUTRES REVENUS

jour		mois		année	
7	8	9	10	11	12

1	2	3	4	5	6

(Récapitulatif des derniers sept jours)

Bloc		village		famille	
13	14	15	16	17	18

T50 TRAVAIL HORS EXPLOITATION (par exemple travail salarié chez un paysan, travail de construction etc ...)

ECM	Nature du travail	Durée (unité d'un jour)	Salaire reçu (en CFA ou en nature)	Employeur	Observations

T51 Commerce (par exemple vente de céréales, bois, cigarettos, cola etc...)

ECM	Nature	Quantité unité locale	Prix d'achat CFA	Prix de vente CFA	Place de vente				Observations
					marché local	marché A.V.V	conces- sion	Autres	

T52 Production hors exploitation (par exemple : production dolo, jong, daba, fabrication de vêtements, fils de coton, etc...)

ECM	Matières premières				Prix de vente CFA	Place de vente				Observations
	Nature	Quant. Uni. lo.	Stock	Prix CFA		H. loc.	H. AVV	Conces.	Autres	

(marquer en observation si les matières premières n'ont pas été utilisées entièrement ou si la production n'a pas été vendue en totalité).

ESTIMATION DES RECOLTES COTON - CAMPAGNE 1978

Ne pas remplir

1	2	3	4	5	6

blocville (famille)

1	2	3	4	5	6	7	8

NOM DE LA SOLE :

NOM DU CE

TABLE 90 : TRAVAUX AGRICOLES

Activités	Date		Intrants Quantité utilisée (si applicable)
	début	fin	
semis			(en sac)
ressolage			(en sac)
1er sarclage			
2e sarclage			
lânage			
buttage			
engraisement			(en sac)
urée			(en sac)
traitement 1			(en boîtes)
2			
3			
4			
5			

TABLE 91 - RECOLTE

Récolte	1er passage	2eme passage	Total
date début			
date fin			
pois échantillon			

TABLE 92 : RENDEMENT

Poids total de la récolte : kg
 superficie : semée : ha ; récoltée : ha
 rendement : kg/ha

Observations :

SUPERFICIE DU CHAMP COTON

Tracez ci-dessous en trait continu (—) le dessin du champ au moment des semis, en utilisant un centimètre pour représenter dix mètres. Ecrivez les dimensions près des côtés. Indiquez l'emplacement des piquets. Plus tard, sur le même dessin, indiquez par un trait pointillé (- - - - -) les parties qui ont été sarclées.

Indiquez ensuite par des (+ + + + +) la partie du champ effectivement récoltée. Ecrivez les dimensions de la partie abandonnée.

Nombre de lignes du champ :

Ne pas remplir

1	2	3	4	5	6
---	---	---	---	---	---

Bloc vill.		fam.	
13	14	15	16
17	18		

CULTURE

NOM DU C.E. :

TABLE 80 - TRAVAIL AGRICOLES

Activité	Date		Intrants
	début	fin	Quantité utilisée (si applicable)
semis			
resemis			
1er sarclage			
2ème sarclage			
Binage			
Battage			
Engraisage			
Urée			

TABLE 81 - RECOLTE

Date début :

date fin :

1°/- Remplissage des paniers

Date	nombre de paniers comptés	Observations (épis ou grains)
.....
.....
.....
.....
.....

Nombre total de panier

2°/- Pesée des paniers

poids du 1er remplissage en épi : kg
 poids du 2e remplissage en épi : kg
 poids du 3e remplissage en épi : kg
 poids du 3em remplissage après battage : kg

TABLE 82 - RENDEMENT

poids total : on épi kg, en graines kg
 superficie souée : ha, récoltée : ha
 rendement : kg/ha
 Observations :

Ne pas remplir

1	2	3	4	5	6

Jardin de case - campagne 1978

bloc	villa.	famill.

Nom du CE :

Tableau 21 - Travaux agricoles

Activité	Date début							Date Fin							Intrants quantité utilisée
	I	II	III	IV	V	VI	VII	I	II	III	IV	V	VI	VII	
Labour															
Ensemencement															
Travaux de sarclage															
Travaux de binage															
Travaux de buttage															
Travaux de graissage															
Travaux de mure															
Travaux de fongicide															
Travaux de pulvérisation															

Les sept cultures les plus importantes dans le jardin de case (à remplir par l'enquêteur, l'ordre n'a pas d'importance)

Tracez de l'autre côté de la fiche un dessin du jardin de case en montrant l'endroit où se trouvent les différentes cultures et leur superficie semée pour chaque culture. Utilisez un centimètre pour représenter 5 mètres. Montrez aussi l'emplacement de la concession.

I. REVENUES PAR CULTURE

Nom du CE

Bloc _____ Village _____ N° _____

	1977	1978	1979
Type d'exploitation	:	:	:
Indice d'activité	:	:	:
Superficie cultivée	:	:	:
Ha/Unité d'activité	:	:	:

Année d'installation _____

Année équipée _____

Type sol _____

	1977				1978			
	Coton	Sorgho			Coton	Sorgho		
A) Rendement Kg/ha	:	:	:	:	:	:	:	:
B) Superficie ha	:	:	:	:	:	:	:	:
C) Revenu agricole CFA	:	:	:	:	:	:	:	:
D) Dépenses variables CFA	:	:	:	:	:	:	:	:
E) Revenu agricole brut par culture, CFA	:	:	:	:	:	:	:	:
F) TOTAL CFA	:	:	:	:	:	:	:	:

	1979			
	Coton	Sorgho		
A) Rendement Kg/ha	:	:	:	:
B) Superficie ha	:	:	:	:
C) Revenu agricole CFA	:	:	:	:
D) Dépenses variables CFA	:	:	:	:
E) Revenu agricole brut par culture, CFA	:	:	:	:
F) TOTAL CFA	:	:	:	:

II.

	1977	1978	1979
Type d'exploitation :	:	:	:
Indice d'activité :	:	:	:
Superficie cultivée :	:	:	:
Ha/unité d'activité :	:	:	:

REVENUES DE L'EXPLOITATION

Année installation
Année équipée
Type sol

	1977	1978	1979
F) Revenu agricole brut par exploitation CFA	:	:	:
G) Revenu jardin de case CFA	:	:	:
H) Dépenses fixes CFA	:	:	:
I) Revenu agricole net par exploitation CFA	:	:	:
J) Revenu agricole net par unité d'activité CFA	:	:	:
K) Revenu net production animale CFA	:	:	:
L) Autres revenus nets CFA	:	:	:
M) Revenu net d'exploitation CFA	:	:	:

TABLER 60 - ACHATS ET ECHANGES DE CEREALES

Date :	Quantité :	Prix :	Donné :	Reçu :			Observations (p.e nat. échange) :
Enquête :	Nature :	(unité loc) :	si acheté :	Cadeau :	Cadeau :	échangé :	

TABLER 70 - SITUATION FAMILIALE

Date :	Éprouve :	Absent :	Visiteur :	Nature :	a :	Observations :
Enquête :				Maladie :	travaillé ? :	

CALENDRIER DES PASSAGES EFFECTUES AUX CHAMPS

Date :	Nature :	Manuel ou :	Nombre :	Progrès travail :			Qualité travail :			Observations :
et moment :	Culture :	Travaux :	de :	début :	en cours :	fin :	bon :	moyen :	mauvais :	
passage :		animale :	personnes :							

Observations _____

PRODUCTION COTON - CAMPAGNE 1979

Nom du CE _____ : Bloc : Vill : Fam :
 _____ : _____ : _____ :
 _____ : _____ : _____ :
 _____ : _____ : _____ :

VARJETE _____
 Champ A.V.V * / Hors A.V.V *

TABLE 90 - TRAVAUX AGRICOLES

Résidu de la récolte passée : Nature _____, brûlé sur le champ * /
 à côté du champ * / enfoui * / _____

Activité	début	Fin	durée Travx jours	Manu Tract Anim	Nbre travail.			Intrants utilisés			
					Concession H.	F.	Aides	Nature	Qtité Locale	Equivalce	
Préparation											
Labour											
Semis											
Resemis											
Sarclage I											
Sarclage II											
Buttage											
Engrais											
Traitent 1											
2											
3											
4											
5											
6											
Récolte											Poids de l'échantillon kg
1° passage											
2° passage											
3° passage											
											Total kg

* Cerclez la bonne réponse.

TABLE 92 - RENDEMENT

Poids total de la récolte _____ kg
 Superficie semée _____ ha. Récoltée _____ ha
 Rendement _____ kg/ha

Observations _____

SUPERFICIE DU CHAMP DE COTON

Tracer ci-dessous le dessin du champ au moment des semis et écrire les dimensions en mètres près des côtés. Indiquer l'emplacement des piquets.

Nombre de lignes : _____
 Situation du champ : _____
 Entretenu ? Tout / en partie / rien / * Raison _____
 Récolté ? Tout / en partie / rien / * raison _____
 Mauvais épis ? oui / non / * explication _____
 Dépôts ? oui / Non : * explication _____

* Cerclez la bonne réponse. Si c'est en partie, dessinez cette partie sur le dessin.

SUPERFICIE DU CHAMP

Tracer ci-dessous le dessin du champ au moment des semailles et écrire les dimensions en mètres près des côtés.

Situation du champ :

Entretenu ? Tout / en partie / rien / * Raison _____

Récolté ? Tout / en partie / rien / * Raison _____

Mauvais épis ? Oui / Non / * Explication _____

Dégâts ? Oui / Non / * Explication _____

Cerclez la bonne réponse. Si c'est en partie, dessinez cette partie sur le dessin.

JARDIN DE CASE - CAMPAGNE 1979

Nom du CE _____

:Ploc :	Vill :	Fam :
:	:	:
:	:	:

TABLE 22 - CULTURES

Résidu de la récolte passée : brûlé au champ * / brûlé à côté du champ * / enfoui * / _____

Cultures	Variété Semée	Intrants utilisés Nature	Quantité Unité	Nbre de récoltés	Poids du Panier en kg	Observations
Sorgho B						
Sorgho R						
Maïs						
Mil						
Niébé						
Haricot						
.....						
.....						
.....						

Situation du champ :

Récolté ? Tout / en partie / rien * / raison _____

Mauvais épis ? Oui / Non / * Explication _____

Dégâts ? Oui / Non / * Explication _____

Tracer de l'autre côté de la fiche un dessin de tout le jardin de case en montrant l'endroit où se trouvent les différentes cultures et la superficie semée pour chaque culture.

Marquer toutes les dimensions en mètres près des côtés. Montrer aussi l'emplacement de la concession.

* Cerclez la bonne réponse. Si c'est un partie, dessiner cette partie sur le dessin.

PRIX AU MARCHÉ LOCAL EN CFA PAR ASSIET

CAMPAGNE 79

MARCHE ET _____

MOIS DE _____

Produit	Date.....			Date.....			Date.....			Poids en kg d'une assiette	Observations
	Prix CFA			Prix CFA			Prix CFA				
	1	2	3	1	2	3	1	2	3		
Sorgho blanc	:	:	:	:	:	:	:	:	:	:	
Sorgho rouge	:	:	:	:	:	:	:	:	:	:	
Mil	:	:	:	:	:	:	:	:	:	:	
Maïs	:	:	:	:	:	:	:	:	:	:	
Sésame	:	:	:	:	:	:	:	:	:	:	
Soja	:	:	:	:	:	:	:	:	:	:	
Riz paddy	:	:	:	:	:	:	:	:	:	:	
Riz décortiqué	:	:	:	:	:	:	:	:	:	:	
Arachide (coque)	:	:	:	:	:	:	:	:	:	:	
Haricot (local)	:	:	:	:	:	:	:	:	:	:	
Niébé	:	:	:	:	:	:	:	:	:	:	

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Remarques _____

Nom du CE: _____

Bloc	Vill.	Famille

Date de mise à jour: _____

ACHAT ET ENTRETIEN DU PETIT EQUIPEMENT

(dabas, cordes à semis, cordes pour les boeufs, etc.)

Nature et Nombre	Prix total CFA	Source					Observations
		Marché local	Marché AVV	Magasin	Artisan AVV	Autre	
Achat							
Reparation							

ACHAT ET ENTRETIEN EQUIPEMENT CULTURE ATTELEE

Nature et Nombre	Prix total CFA	Source					Observations
		Marché local	Marché AVV	Magasin	Artisan AVV	Autre	
Achat							
Reparation							

Nom du CE _____

14

Bloc	Vill.	Fam.

Membres de la famille ayant une activité autre que l'agriculture:

Nom	Lien de parenté avec CE	Activité à l'AVV	Activité au Village d'origine

Est-ce que vous avez fait une réserve fourragère en 1979? _____

Qu'est-ce que c'était? _____

Quand a-t-elle été finie? _____

Quels animaux avez-vous nourris avec la réserve? _____

Est-ce qu'on a donné autre chose à manger aux animaux? _____

Si oui: Quoi? _____

A qui? _____

A quelle période de l'année? _____

A-t-on donné: tous les jours, quelques fois par semaine ou seulement de temps en temps?

Inventaire du troupeau en mai 1980

Nature	Prix si acheté	Année d'acquisition	Propriétaire

Achats du stock pour le commerce

Date de l'enquête	Nature	Quantité	Prix total d'achat	Prix de vente par unité	Observations

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Enquête sur les activités artisanales

Type d'artisanat: _____ 14

Bloc	Vill.	Fam.

Nom de l'artisan: _____

Lien de parenté avec le CE: _____

Autres membres de la famille ayant des activités non-agricoles:

Nom	Lien de parenté avec CE	Activité a l'AVV	Activité au Village d'origine

Est-ce que l'artisan faisait la même chose au village d'origine: _____

Où obtient-il la matière première: _____

Où vend-il sa production: _____

Inventaire de l'équipement utilisé par l'artisan en mai 1980

Nature	Année d'acquisition	Prix d'achat	Etat en mai 1980

Etat du stock des matières premières en mai 1980

Nature	Prix si acheté

Achat et entretien de l'équipement utilisé par l'artisan

Date de l'enquête	Nature	Type de dépense		Prix en CFA	Observations
		achat	réparation		

Achat de matières premières

Date de l'enquête	Nature	Quantité	Prix total	Observations

Articles vendus

Date de l'enquête	Nature	Quantité	Prix total	Observations

Quantité de travail fournie

Date de l'enquête	Observations

PRODUCTION COTON CAMPAGNE 1980

Nom du CE _____

Champ AVV / Hors AVV*

Nom du sol _____

Variété _____

Bloc	Vill.	Fam.

Residu de la récolte passée Nature brûlé sur le champ / brûlé à côté
du champ / enfoui* / quand?

TRAVAUX AGRICOLES

Activité	Période		Durée total travaux en jours	Manuel Traction animal	Nombre trav. concession		Travailleurs non-familial						
	Date Début	Date Fin			H	F	Nombre de personnes	Durée en jours	Type				
	Echange								In- vita- tion	Sal- aria- CFA	Autre		
Preparation													
Labour													
Semis													
Resemis 1													
2													
Sarclage 1													
2													
Battage													
Traitement 1													
2													
Endrine*													
Nivacron 3													
4													
5													
6													
Recolte													
1 ^{er} passage													
2 ^e passage													
3 ^e passage													

* Circler la bonne réponse

Observations

UTILISATION DES BOEUFs

Activité	Nombre de personnes			Profondeur	Espacement	Observation
	Homme	Femme	Enfant			
Scarifiage						
Labour						
Sarclage 1						
2						
Battage						

ENGRAIS

Type	Quantité et Moment d'application				Observations
	Avant labour nombre de sac	Après labour Nombre de sac	Moment de semis nombre de sac	Moment de sarclage nombre de sac	
NPK					
Urée					

TRAITEMENTS: ENDRINE/NIVACRON

Trait 1	Trait 2	Trait 3	Trait 4	Trait 5	Trait 6	TOTAL

Nombre de lignes 1^{er} côté _____
2^e côté _____

Direction des lignes par rapport à la pente* dans le même sens
dans le sens contraire
autre.....

Situation du champ _____

Entretenu? Tout / en partie** / rien / *Raison

Récolté? Tout / en partie** / rien / *Raison

Mauvais épis? Oui / Non / *explication

Degâts? Oui / Non / *explication (Betail des Peuhls/village, Animaux sauvages,
Inondations, Période de secheresse de à....., etc.)

* Cercler la bonne reponse

** Dessiner cette partie sur le dessin

Poids de l'échantillon

1^{er} passage _____ kg

2^e passage _____ kg

3^e passage _____ kg

RENDEMENT TOTAL

Poids total de la récolte _____ kg

Superficie semée _____ ha

Superficie à mettre en valeur _____ ha

Rendement _____ kg/ha

Superficie récoltée _____ ha

Situation du champ

Date

Observation

Calendrier de mise à jour de la fiche:

PRODUCTION GRANDES CULTURES CAMPAGNE 1980

Nom du CE _____

Bloc Vill. Fam.

CHAMP AVV / HORS AVV*

Culture Variété

Nom de la sole:

Residu de la récolte passée: Nature , brûlé sur le champ / brûlé à côté du champ / enfoui* / quand?.....

TRAVAUX AGRICOLES

Activité	Période		Durée total travaux en jours	Manuel Traction animal	Nombre trav. concession		Travailleurs non-familial						
	Date Début	Date Fin			H	F	Nombre de personnes	Durée en jours	Type	Echange	In-vita-tion	Sal-aria-tion CFA	
Preparation													
Labour													
Semis													
Resemis 1													
2													
Sarclage 1													
2													
Battage													
Traitement 1													
2													
Endrine*													
Nivacron 3													
4													
5													
6													
Recolte													
1er passage													
2e passage													
3e passage													

* Circler la bonne réponse

Observations

UTILISATION DES BOEUFs

Activité	Nombre de personnes			Profondeur	Espacement	Observation
	Homme	Femme	Enfant			
Scarifiage						
Labour						
Sarclage 1						
2						
Battage						

ENGRAIS

Type	Quantité et Moment d'application				Observations
	Avant labour nombre de sac	Après labour Nombre de sac	Moment de semis nombre de sac	Moment de sarclage nombre de sac	
NPK					

Location des lignes par rapport à la pente* dans le même sens
dans le sens contraire
autre

Situation du champ:

Entretenu? Tout / en partie** / rien / *Raison

Récolté? Tout / en partie** / rien / *Raison

Mauvais épis? Oui / Non / *Explication

Dégâts? Oui / Non / *Explication (Bétail des Peuhls / village, animaux sauvages,
Inondations, période de sécheresse de à)

* Circler la bonne réponse

** Dessiner cette partie sur le dessin

Estimation de stock qui reste de l'an passé (au moment de récolte)

RECOLTE

1) Remplissage des paniers

Date	Nombre de paniers complis ce jour-là	Observations (épis/graines) etc.
------	---	-------------------------------------

Nombre total de paniers:

2) Pesée des paniers

Poids du 1 ^{er} remplissage en épi	_____ kg
Poids du 2 ^e remplissage en épi	_____ kg
Poids du 3 ^e remplissage en épi	_____ kg = après battage _____ kg

RENDEMENT

Poids total en épi _____ kg	en graines _____ kg
Superficie a mettre en valeur _____ ha	Superficie semie _____ ha
Superficie récoltée _____ ha	Rendement _____ kg/ha

Situation du champ

Date _____ Observation _____

Calendrier de mise à jour de la fiche

JARDIN DE CASE ET PETIT JARDINAGE CAMPAGNE 1980

Nom du CE _____

Bloc	Vill.	Fam.

CULTURES

Cultures	Variété semée	Engrais utilisé		Nombre de paniers récoltés	Poids d'un panier (kg)	Laboure t.b.	Sarclé t.b.	Semé en ligne	Cult. change	Qui a * travaillé	Qui a * possédé la récolte
		Nat.	Quant.								
Jardin de case											
Sorgho blanc											
Sorgho rouge											
Mais											
Mil											
Niébé											
Haricots											

Jardinage											

* Indiquer CE, H (homme), F (femme)

Dégâts Oui / Non** explication.....

Jardinage aménagé / arrosé / irrigué**

Observations

** Circler la bonne réponse

ANNEX III

- Table 51. Importance of Crops by Area Planted per Unit of Labor as Percentage of the Total Farm Area of 1978 per Cluster and Phase of Farm Development.
- Table 52. Gross Revenue in CFA per Unit of Labor According to the Class of labor Index and Cluster in 1978 by Phase of Farm Development.
- Table 53. Average Area cultivated per Unit of Labor (Excluding House Garden) by Unit of Labor of the Family and Cluster of Villages.
- Table 54. Evolution of an AVV Farm (Type I-III) During the Different Stages of Development: Results from the 1978 Sample.

TABLE 51

Importance of Crops by Area Planted per Unit of Labor as a Percentage of the Total Farm Area of 1978 per Cluster and Phase of Farm Development.

Cluster	Phase of Farm Development	Area Cultivated per Unit of Labor (ha)	Importance of Crop (in % of total)						
			Cotton	Sorghum White	Sorghum Red	Corn	Cowpeas	Peanuts	Other
Linoghin	first year*	.6	41	59	--	--	--	--	--
	developing	1.3	31	54	10	--	3	--	2
Mogtedo	first year*	.8	47	53	--	--	--	--	--
	second year*	1.3	50	49	--	--	.5	.5	--
	developing	1.1	40	52	--	--	1	--	1
Bane	second year developing	1.4	34	44	18	--	3	--	--
		1.5	34	44	20	--	1	--	1
Kaibo Nord	second year* developing	1.1	38	39	--	--	--	--	23
		1.2	43	52	--	--	--	--	5
Kaibo Sud	first year* developing	.7	45	51	--	.5	3	--	.5
		1.0	35	46	5	6	7	--	1

* farmers who are not equipped

TABLE 52

Gross Revenue in CFA per Unit of Labor
According to the Class of Labor Index and Cluster in 1978 by Phase of Farm Development.

Cluster	Phase of Farm Development	Number of Labor Units per Family				Average Gross Income per Unit of Labor Crop Season		
		1.75-2.25	2.50-3.25	3.50-4.50	4.75 and over	1977	1978	1979
Linoghin	first year*	54,100	--	--	20,300	--	41,300	--
	developing	59,900	38,000	--	38,700	52,000	48,500	63,100
Mogtedo	first year*	--65,800**	--	--	--	--	52,900	61,000
	second year*	58,500	28,100	--	--	--	48,400	68,900
	developing	--	--	44,300	56,700	58,500	47,300	53,400
Bane	developing	147,400	75,900	111,300	65,700	--	103,400	67,200
Kaibo Nord	developing*	24,000	11,200	--	--	--	19,700	--
	developing	--60,100**	--	--	--	--	59,100	59,000
Kaibo Sud	first year*	--42,600**	--	--	--	--	31,700	--
	developing	75,400	66,200	42,900	48,900	52,400	59,400	23,600

* farmers who are not equipped

** class 1.75-2.25 and 2.50-3.25 combined.

TABLE 53

Average Area Cultivated per Unit of Labor (Excluding House Garden)
by Unit of Labor of the Family and Cluster of Villages.

Cluster	Stage of Development	Class of Units of Labor			
		1.75-2.25	2.50-3.25	3.50-4.25	4.75 and over
Linoghin	first year*	.99			.36
	developing	2.64	1.40		1.30
Mogtedo	first year*		.92 ¹		
	second year* developing	1.69	.84	--	--
		--	--	1.02	1.06
Bane	developing	2.21	1.62	1.49	.96
Kaibo	developing*	.83	.83		
Nord	developing	--	1.29 ¹	--	--
Kaibo	first year*		1.17 ¹		
Sud	developing	1.19	--	1.02	.96

* farmers without animal traction

¹ class 1.75-3.25

TABLE 54

Evolution of an AVV Farm (Type I-III) During the Different Stages of Development:
Results from the 1978 Sample

Family Type	Crop	Acreage in ha According to the Phase of Development of the Farm								
		Linoghin/Mogtedo			Bane			Kaibo Nord and Sud		
		First Year	Second Year	Developing Year	First Year	Second Year	Developing Year	First Year	Second Year	Developing Year
IA	Cotton	.8	1.2	1.4		1.4	1.6	.9	1.0	1.0
	White Sorghum	1.1	1.0	1.9		1.8	2.3	1.0	1.0	1.4
	Red Sorghum	--	--	.5		.7	.7	--	--	--
	Cowpeas	--	.1	.3		.2	.1	.1	--	.1
	Peanuts	--	--	--		--	--	--	--	--
	Millet	--	--	.1		--	--	--	--	--
	Other	--	--	--		--	.1	--	--	.1
	TOTAL	1.9	2.3	4.2		4.1	4.8	2.0	2.0	2.6
IB	Cotton	.8	1.4	1.5		1.5	1.5	1.1		1.1
	White Sorghum	.9	1.5	2.1		1.9	2.2	1.2		1.5
	Red Sorghum	--	--	.2		.9	1.0	--		.3
	Cowpeas	--	--	.1		.1	--	.1		.1
	Peanuts	--	--	--		--	--	--		--
	Millet	--	--	--		--	--	--		--
	Other	--	--	.1		--	.1	--		--
	TOTAL	1.7	2.9	4.0		4.4	4.8	2.4		3.0
II	Cotton	.9		2.1			2.5		1.6	1.4
	White Sorghum	1.2		3.0			2.1		1.5	2.8
	Red Sorghum	--		.2			1.2		.7	.2
	Cowpeas	--		.2			.1		.1	.2
	Peanuts	--		--			--		--	--
	Millet	--		--			--		--	--
	Other	--		.1			--		.2	.4
	TOTAL	2.1		5.6			5.9		4.1	5.0
III	Cotton	1.5		2.1			2.2			1.4
	White Sorghum	1.5		3.2			2.6			3.1
	Red Sorghum	--		.2			1.5			--
	Cowpeas	--		.3			--			.2
	Peanuts	--		--			--			--
	Millet	--		--			--			--
	Other	--		.2			--			.5
	TOTAL	3.0		6.0			6.3			5.2