INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT

INTERNATIONAL DEVELOPMENT ASSOCIATION

THE ECONOMIC DEVELOPMENT OF UPPER VOLTA

(in four volumes)

VOLUME II

AGRICULTURE

November 27, 1970

Western Africa Department

CURRENCY EQUIVALENTS

Currency Unit: CFA Franc (CFAF)

Before August 11, 1969:
US$ 1.00 = CFAF 246.85
CFAF 1,000 = US$ 4.05

After August 11, 1969:
US$ 1.00 = CFAF 277.71
CFAF 1,000 = US$ 3.60

WEIGHTS AND MEASURES

1 Metric Ton (t)	= 2,205 lbs.
1 Kilogram (kg)	= 2.2 lbs.
1 Kilometer (km)	= 0.62 mile
1 Meter (m)	= 3.28 feet

COMPOSITION OF MISSION

This report is based on the findings of a Mission which visited Upper Volta in November-December 1969 and which consisted of:

John C. de Wilde	Chief of Mission
Frédy R. G. Holin	Economist
H. Casati	Consultant-Agricultural Economist (FAO)
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The report consists of the following volumes:

I Main Report
II Agriculture
III Livestock
IV Education

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BASIC DATA

1. Area: 274,122 square km

2. Population:

		1966	1969 [1/]
Total		4,740,000	5,030,000
including:	urban population	305,000	320,000
	rural population	4,135,000	4,410,000
	migrants	290,000	300,000

Net rate of increase: 2% per annum for the whole population.

3. Economic Data: (1966)

GDP (in millions of CFA francs):		58,220
Including:	agriculture	19,373.5
	forestry and hunting	2,793.0
	livestock	5,726.5
	fishing	467.0
	Total rural production i.e. 48.8% of GDP	28,360.0
Production for	domestic consumption	20,268.0
	marketed production	8,092.0

Average GDP per capita (1966):

GDP per head of population:	CFAF	12,300	(U.S. $49)
GDP per head of rural population:	CFAF	6,800	(U.S. $28)
including:- subsistence production:	CFAF	4,900	(U.S. $20)
cash crops:	CFAF	1,900	(U.S. $ 8)

1/ Figures for the urban population and for migrant workers vary according to the sources used: between 275,000 and 320,000 for the population in the towns, and between 300,000 and 370,000 for migrants.

SUMMARY AND CONCLUSIONS

The Present Position

i. The available statistical data are not such as to allow a precise evaluation of the present position or of recent developments in the agricultural economy of Upper Volta.

ii. Food production per capita seems to have remained stationary, the output of cotton has increased more rapidly than was expected; and both production and consumption of rice have also risen. However, with the exception of cotton, none of these commodities has shown any real improvement in yield; the increased supply is merely the result of expanding the area under cultivation.

iii. The present system of "agriculture plus livestock raising" is increasing the pressure on available land resources; in some regions this is evidenced by a shortage of land, both for cultivation and for grazing, and by population movements, including temporary emigration of workers to Ghana and Ivory Coast, and permanent migration to less populated parts of Upper Volta from the Mossi region.

iv. The marketing of cash crops is relatively satisfactory in spite of the poor state of local roads which makes transport difficult and costly. On the other hand, marketing for food crops is very inadequate, resulting in trading difficulties with areas where there are food shortages, such as the East and North.

v. The agricultural development program depends on external financing and on technical assistance provided by foreign companies ("societes d'intervention") which have rather high operating costs and for which the Government must provide considerable counterpart funds from its budget. The future prospect for such financing is uncertain.

vi. The Upper Volta Government has not been able to prepare any specific rural projects involving productive use of investment funds as part of the present National Plan, except for the Black Volta cotton project, for which the planning was done with the help of outside funds and foreign experts.

The Possibilities of Rural Development

vii. In general, the role of agriculture in the development of the Upper Volta economy and its foreign trade is likely to remain less important than that of animal husbandry.

viii. The agricultural potential of Upper Volta is limited owing to unfavorable physical conditions (poor soil, lack of water, etc.), the low level of technical knowledge among farmers, and the shortage of local senior staff. However, some degree of agricultural development can be achieved:

(a) by ensuring a better distribution of the population in relation to the land which is actually under cultivation or could be covered for agricultural use;

(b) by extending cultivation of cash crops: in the first place, cotton, and after that, rice;

(c) by increasing the production of food crops such as millet and sorghum to improve the staple diet of the people.

x. Upper Volta should encourage the slow, steady development of a system of "mixed farming" because under existing conditions of land shortage and population pressure the area under cultivation can be extended only at the expense of the livestock ranges.

Recommendations

xi. Implementation of the recommendations set out more fully later in the mission report is subject to the completion of certain essential general studies (e.g. demographic and agricultural surveys) and the preparation of specific projects suitable for external financing.

xii. Project offices should accordingly be established within the Ministry of Agriculture and the Ministry of Planning to prepare the project documentation required to justify financing.

xiii. In allocating the available public resources, whether domestic or foreign, priority should be given to:

(a) the encouragement of production plans most likely to bring about substantial increase in individual money incomes in rural areas;

(b) the development of regions which at present are sparsely populated or virtually empty and which could absorb the excess rural population of the Mossi plateau, namely the lightly populated zones in the South-West and South-East, and the valleys of the Mossi plateau, especially that of the White Volta river.

xiv. Within the framework of such a program, the traditional distinction between investment and recurring costs should be abandoned, and the available funds should be applied to finance whatever measures are most likely to raise production, irrespective of whether they entail new investment or an increase in operating costs of government services (for example, livestock and agricultural extension services) or a combination of the two.

xv. In the agricultural sector, priority should be given to developing cotton production, which is making good progress at the present time, particularly in the Black Volta area. However, it is recommended that:

(a) an overall long-term production target be set (120,000 tons of cottonseed would seem to be the maximum), taking into account the forecasts for West African production as a whole and the quantity that can be disposed of on the world market; 1/

(b) this production target be allocated among the various producing regions.

xvi. The proposed settlement of new lands requires the elaboration of projects that are technically and economically feasible, including:

- general inventory of all the suitable areas;

- an effective international campaign against onchocerciasis (river blindness), which has made many of the uninhabited zones unusable;

- the preparation of plans for the development of production and necessary infrastructure in certain priority areas of Upper Volta (e.g. the White Volta River Valley).

xvii. With respect to water resources, the Mission believes that new dams, the cost of which has been shown to be prohibitive, should not be constructed. Instead, available resources should be utilized by:

(a) developing small, low-cost irrigation schemes below existing dams; small projects of this kind should be financed in each ORD;

(b) providing watering points or wells for human and animal use; and

(c) developing simple schemes for the partial control of water in cotton lands (bas-fonds).

Most of the irrigated land should be used for growing rice.

xviii. In view of the high cost of foreign managed extension services, Upper Volta should consider very seriously ways of reducing the cost of such services, in particular by training local professional staff capable of replacing foreign experts.

xix. In the research and development field, an effort should be made to tailor both research programs and available means to the priority aim

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1/ In fixing this target, the availability of funds in the Upper Volta budget for maintaining minimum price levels must also be considered.

of increasing the yield of food crops. The widespread introduction of improved varieties of sorghum and millet should be the chief short-term goal.

xx. It is clear that an increase in production will also depend on an improvement in marketing and infrastructure, and on investment in processing facilities.

xxi. The present agricultural program, based essentially on one cash crop, should be diversified as far as possible by improving the production of food and feed, and by the progressive integration of animal husbandry with agriculture. The areas where priority should be given to development of mixed farming are chiefly in the South-West (Banfora) and South-East (Fada N'Gourma) where there is still sufficient land available, unlike the Mossi plateau which is relatively over-populated and over-exploited.

xxii. Measures to diversify crop production and encourage mixed farming depend on the reinforcemnt of existing programs for educating farmers and training extension staff. This program should be extended to cover other regions which are suitable for development and where new land is to be brought into production. In the long run, the scope of the program should be broadened beyond the immediate task of promoting cash crops so as to achieve an integrated plan of rural development which would comprise such activities as the organization of groups of producers at a pre-cooperative level, the improvement of marketing procedures, the re-allocation of cultivated land around village communities, the use of animals for farm work as well as their fattening for slaughter, the maintenance and reconstruction of access roads, and the exploitation of valley bottoms for rice-growing. Such a long-term program will of course require time to mature; it would nevertheless seem to offer the best chance of improving the rural economy of Upper Volta and of raising the standard of living of the farmers.

I. THE CHARACTERISTICS AND STATE OF AGRICULTURE

A. The Constraints

1. Natural, human, technical and economic conditions are not favorable to agricultural development.

Harsh Climate and Poor Soils

2. Over the greater part of the country, the annual rainfall is slight (less than 900 to 1000 mm) and the rainy period only lasts four months. There are considerable variations in rainfall from year to year (in the range of about 20 percent) and its distribution over the season, particularly at the beginning of the cropping period. The extreme South-West (Bobo-Dioulasso, Banfora and Gaoua) has the highest rainfall (1100 to 1300 mm over 4 or 5 months, or occasionally 6 months). High average daily temperatures in the dry season -- between 26°C (79°F) and 30°C (86°F) -- and in the rainy season -- 25°C (77°F) and 27°C (81°F) -- and the constant blowing of the harmattan (desert wind) from November to April, cause a high rate of evaporation, always in excess of 2000 mm annually. This type of climate only permits the cultivation of fast-growing, drought-resistant annual crops (millet, sorghum, cotton, groundnuts, sesame) and prevents the cultivation of perennial high-value tree crops. Even in the South only mangoes and cashews can be cultivated without irrigation; the more demanding crops (sugarcane, rice and citrus) must be irrigated. The shortness of the rainy season causes frequent bottlenecks in the use of agricultural labor, especially in preparing the fields for planting and in weeding, thus limiting the area which can be cultivated. The beginning of the rainy season is so erratic that sowing often has to be repeated several times, and it is difficult to fix the optimum planting date in any given year.

3. Sedimentary soils, usually of granitic or sandstone origin, have a low production potential, and are frequently characterized by an underlying lateritic hard pan, sometimes very close to the surface, which prevents proper drainage and limits the root development of crops, causing them to suffer from too much or too little water depending on the rainfall at different periods. These soils are also poor in phosphoric acid and nitrogen. The soils formed from schists or basic rocks are richer in nutrients and have better physical properties, but the area where these are found is very limited. All these different soils are very much subject to heavy erosion, particularly by rainstorms after the natural vegetation has disappeared, either at the end of the dry season or immediately after sowing. The soils in the valley bottoms, which contain a lot of clay and organic matter, are the most fertile, but they are difficult to plow and to drain because of their texture.

4. The land has little relief, which makes it difficult to construct irrigation systems, although these would be of value. The valleys are not very deep, so that the dams often have to be very long and the reservoirs are

shallow. The resulting loss by evaporation is very great (80 - 85 percent) and the cost per cubic meter of water actually used is exceptionally high (CFAF 100 to 200 per cubic meter). Since the land only slopes very gently, it is difficult to ensure proper drainage and to protect irrigated areas in time of flood.

Over-exploitation and Lack of Equipment

5. The natural disadvantages of the environment are further accentuated by the unequal distribution of population. The greatest densities, more than 80 inhabitants per square kilometer, are to be found on the Mossi plateau. Considering the poverty of its granitic soils, and the limited annual rainfall of between 650 and 880 mm., 0.4 to 0.5 hectares of cropped land are required per head of population under traditional methods of cultivation, and fields should be allowed a fallow period of at least 4 years to maintain a proper level of fertility. Allowing for the fact that between 5 and 10 percent of the land cannot be cultivated because it has a hard pan or is too rocky, or because it is taken up by roads and village settlements, the Mossi plateau should in theory not support a population of more than about 40 inhabitants per square kilometer. In fact, the continuing increase in population has entailed a shortening of the fallow period, with a consequent impoverishment of soils which were already far from fertile. On the other hand, there are vast areas both in the East and the South-West which are almost uninhabited. The South-West region is so sparsely populated that, although the potential for production is considerably higher than elsewhere it cannot be fully exploited. Health conditions also hinder cultivation, particularly in the valleys were onchocerciasis is prevalent. In other areas farmers are debilitated by malaria and Guinea-worm, particularly at the beginning of the rainy season, just when much hard work is necessary. Human trypanosomiasis either prevents or hinders development of the wooded areas in the south, and animal trypanosomiasis is a very serious handicap to livestock raising in the agricultural regions.

6. Farmers generally lack the means of production they need to overcome the problems with which they are beset. The soils are so poor that chemical fertilizers and manure are essential; and seasonal labor bottlenecks really require the draft equipment for land preparation, ploughing and weeding. But most of the farms produce chiefly subsistence crops for family consumption, and farmers therefore have difficulty in obtaining sufficient cash to buy either fertilizers or farm equipment. The problems of farming in these conditions are compounded by the separation of agriculture and livestock raising; indeed, because of the prevalence of parasitic diseases, the difficulty of pasturing animals in cultivated areas, especially where less and less land is left fallow as over the greater part of the Mossi plateau, and the shortage of fodder and water in the dry season, the farmers are much more inclined to entrust any cattle they may possess to the care of herdsmen than to keep them permanently on their farms. This practice, together with a certain reluctance on the part of farmers to engage

in animal husbandry, increases the difficulty of introducing the use of animal-drawn equipment and manure on the farms. Moreover, the social structure is so strongly hierarchical that there is little opportunity for the younger farmers to use their initiative, since they have no control over the family property, either land or cattle.

Shortage of Senior Staff and Equipment in the Agricultural Services

7. Shortage of qualified staff in the agricultural development services makes it difficult to provide farmers with the technical advice they need. The lack of necessary equipment for this work (vehicles, small farm machinery and supplies) is even more serious. The agricultural research agencies have only very limited facilities and can only deal with the most urgent problems. IRAT (Institut de Recherches Agronomiques Tropicales et des Cultures Vivrieres) has three experimental stations at Saria (for the selection of suitable strains of sorghum and millet, fertilizer trials on subsistence crops, and the testing of different types of animal-drawn equipment), at Moghtedo (rice-growing and irrigation farming) and at Farako Ba (market-gardening, production of fodder and sugarcane trials). IRHO (Institut de Recerches pour les Huiles et Oleagineux) has a station at Niangoloko (variety and fertilizer trials on groundnuts and sesame) and cooperates with IRAT on experiments with groundnuts at Saria. IRCT (Institut de Recherches du Coton et des Textiles Exotiques) has an officer at Bobo-Dioulasso who is doing experimental work on cotton at Saria and at various places in the cotton producing area. SESUHV (Societe d'Etudes Sucrieres de Haute Volta) is conducting trials with sugar cane near Banfora. MAVOCI (Manufacture Voltaique de Cigarettes) is experimenting with tobacco growing near Hounde. ORSTOM (Office de la Recherche Scientifique et Technique Outremer) has carried out several soil surveys and studies and produced a general soil map of Upper Volta on the scale 1:500,000 and a soil map of the Red and White Volta River valleys on a scale of 1:200,000.

B. The Present Position of Agriculture in Upper Volta

Agriculture and Livestock

8. Agriculture and livestock are the mainstays of the Upper Volta economy. Together they contribute 43 percent of GDP (agriculture, 33 percent; livestock, 10 percent). Forestry, hunting and fishing account for about 6 percent of GDP. The other economic sectors are in fact very closely dependent on the rural sector, which is the principal source of economic activity. The area cultivated in any one year is about 1.9 million hectares, i.e. 0.45 ha per rural inhabitant and about 2.5 ha per family. Gross income from agriculture is about CFAF 20 billion, which works out at about CFAF 10,000 (US$36) per hectare under cultivation. Stockbreeding produces very much less: gross income from that source has been put at CFAF 5.7 billion, i.e., about CFAF 250 (US$1) per hectare, using the Plan estimate of the area under extensive grazing.

9. The value of agricultural output is thus greater than that of any other activity. About 85 percent of the resident population is engaged in agriculture. Livestock production is much more concentrated. In most of the agricultural areas, it is entirely in the hands of semi-nomadic tribesmen of the Fulani tribe, who constitute about 5.5 percent of the population. The Fulani raise their own herds, but they also take charge of livestock belonging to sedentary farmers, who get some income from their cattle only when they sell them in case of need. 1/ In the northern part of the country, stock breeding is even more specialized and is the chief occupation of a small number of nomadic Touareg, Bellah and Fulani herdsmen. The value added by the livestock sector of the economy gains is supplemented by that derived from the transit through Upper Volta of cattle from Mali and Nigeria to the countries on the coast. As a result livestock makes a much greater contribution to foreign trade than agriculture. Livestock and livestock products rank first in the country's exports representing 53 percent of the recorded total, while agricultural products (cotton, groundnuts, sheanuts, sesame, etc.) only account for 38 percent. This disparity serves to underline the fact that agriculture and stockbreeding are quite separate and even competitive activities.

The System of Land Tenure

10. The development of farming in Upper Volta is governed by systems of land-tenure and cultivation which have certain characteristics in common, although they may vary according to the ethnic groups, regions and density of population.

11. All land ownership depends on an absolute right of a religious nature vested in various classes of land-holding chiefs (chefs de terre). Farms are established on the basis of various types of user rights, which may be grouped according to four categories of land tenure:

(a) permanent user rights held by heads of farm families who belong to a lignage group whose chief has a right of collective possession;

(b) permanent user rights resulting from clearance of virgin land;

(c) inherited user rights. This user right tends to become permanent after two or three generations;

(d) temporary user rights granted by the holder of a permanent user right or of a right of collective possession (indirect tenure).

1/ Statistics on the numbers of livestock do not show what proportion of the total number belong to herdsmen or to sedentary cultivators.

12. These various types of land tenure are found in Upper Volta in the following proportions, according to a sample survey: 1/

System of Tenure	Percentage of cultivated fields
(a)	54
(b)	14
(c)	6
(d)	26
Total	100

13. The survey shows on the one hand that new rights are being created to previously unused land (14%), and on the other that indirect tenure plays a large part (a quarter of the total number of fields are worked on such temporary tenure).

14. A large proportion of the fields thus worked on temporary tenure belong to chefs de terre (in Mossi 32%, in Senoufo and Gourounsi 60%, in Bobo 30%). Since there are not many of these chiefs, it is clear that ownership of the land is very unequal and that property is concentrated in a few hands. The number of farmers without a permanent right to the land they work is large, as can be seen from the number of fields on loan. However, the system of tenure varies according to the population density. In the Bobo, Marka, Samo, and Senoufo regions, where there are only about 15 to 20 inhabitants per square kilometer, a quarter of the cultivated fields are clearings in virgin bush. By contrast, in the Mossi and Bissa regions with a high population density (30 to 40 inhabitants to the square kilometer), the land shortage is evidenced by the large proportion of fields lent to relatives (more than one-third of the cultivated fields are on loan).

15. Most of the cultivation in Upper Volta is on individual farms, worked by one monogamous or polygamous family (between 6 and 9 persons). However, forms of collective at the level of lignage or "extended family" groups still exist. The land cultivated includes both fields in the village and fields out in the bush. Each farm comprises between 2.5 and 3.7 parcels of land. The fallow fields are often contiguous, which means that according to the length of time the land is left fallow (varying from 4 to 15 years) the area belonging to one farm is from 15 to 50 hectares.

1/ G. Bouthillier. "Les Structures foncieres en Haute Volta. Resultat d'une enquete par sondage". (Land tenure patterns in Upper Volta. Data resulting from a sample survey.) Institut Voltaique de Recherche Scientifique.

Estimates of Agricultural Production

16. It is very difficult to make any estimates of agricultural production, as no proper survey has been carried out. The statistical data available have been established by methods open to serious criticism and present such distortions that the mission has not attempted to make use of them. Only the data regarding production marketed by the modern sector are reasonably reliable. The mission has therefore been obliged to make revised estimates giving approximations that are at least consistent and acceptable. The notes accompanying Table II, Annex I, "Production and Consumption of Selected Crops", indicate the basis for these estimates and the reasons why they differ from the official statistics. Comments on the data in this table will be found below in the sections dealing with the various types of agricultural production.

17. The estimates put forward thus only represent orders of magnitude. Moreover, the variations from year to year are so great that caution is required in assessing development over a long period. A study made by the mission on the basis of information collected by experimental stations (for details see Annex I) shows a considerable variation in yields, which are very dependent on the amount of rainfall. Thus, for the whole of Upper Volta, the yields of sorghum sown in demonstration plots may show a variation, in any one year out of three, of plus or minus 100 in relation to a recorded average yield of 620 kilograms per hectare. This means that in one year out of three the production may be less than 520 kilograms per hectare or more than 720. Similar variations have been observed where the soil is treated with manure or chemical fertilizers; the average yield is certainly higher when fertilizer is used, but the variation in yield is the same as in the case of traditional methods of cultivation without fertilizers. Variations in yields have been estimated as follows:

45% for sorghum and millet
16% for groundnuts
20% for cotton

This means that the level of total production is very variable and difficult to evaluate. 1/

Subsistence Crops

18. The basic food crops are sorghum and millet, which occupy about 1.4 million hectares. Present production is of the order of 850,000 tons in a normal year; the proportion is about two-thirds sorghum and one-third millet, and the average yield is about 6 quintals per hectare. In most of Upper Volta sowing is done on the flat, except for the South-West, where sowing is on ridges. Climatic conditions result in very considerable

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1/ See Annex I, Table I, Land Use; and Table II, Production and Consumption of Selected Crops.

variations from region to region and from year to year, as has already been noted. Thus, some regions (Yatenga, East Upper Volta, Sahel) occasionally have food deficits, while the West and South of the country (Banfora, Bobo-Dioulasso, Koudougou) normally have an export surplus.

19. It is estimated that over a long period production has kept pace with increases in population. The increase in production varies, however, from region to region; in the central Mossi country and Yatenga where population density is on average 40 to 50 inhabitants to the square kilometer (and frequently goes as high as 100 to 150), the area under cultivation has only been increased at the cost of reducing fallow, and in some cases even eliminating it entirely. On the other hand, in the zones where the population is less dense (in the East and South), there is still fresh land to be brought under cultivation. Modern methods of farming have had only a very slight effect on the total volume of food production. According to estimates of the Ministry of Planning, measures to improve yields (for example, the disinfection of seed with thioral and the impact of cotton fertilizer applications on subsequent foodcrops) accounted for only 1.5 percent and 2.5 percent of total production in 1967 and 1968 respectively.

20. Sorghum and millet are produced mainly for family consumption. They are eaten as a bread dough, as porridge, in the form of semolina, or made into beer (known as "dolo"). The latter is said to account for one fifth of the total production of sorghum, especially the red variety. 1/ It is estimated that 15 percent of the production of sorghum and millet is marketed in the towns or sold to regions which suffer occasionally from shortages. 2/ An unknown proportion of the production is bought up for speculation, in anticipation of resale at higher prices during the period of shortage just preceding the next harvest (September-October).

21. Maize and fonio provide supplementary foodstuffs which should not be overlooked. The production of maize is of the order of 100,000 tons and that of fonio about 10,000 tons per year. Beans are exported in some quantity, amounting in 1968 to CFAF 72 million, equal to about one-fourth of groundnut exports. Traditional crops also include yams in the South. The amount produced is not known, but it is not sufficient at present to meet the demands of the towns and rural markets. These demands are met by uncontrolled imports of yams from Ghana.

22. Rice is still a marginal product in the Upper Volta economy. It is considered as a "luxury" foodstuff and commands a retail price three times that of sorghum. The consumption of rice is increasing steadily. Production is reported to have more than doubled in 10 years, increasing from 16,000 tons (average for 1958-1959) to around 35,000 to 40,000 tons in 1968. The production of good quality rice is still insufficient and is

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1/ Kellerman report.

2/ SEDES survey (1966).

supplemented by imports, which also have increased between 1964 and 1968, as is shown by the following figures (in thousands of tons):

1964	1965	1966	1967	1968
3.5	3.3	4.1	3.8	(4.0)

23. Most of the rice is grown in areas which are flooded in the rainy season, covering a total of about 40,000 hectares. The average yield has been estimated at 870 kilograms per hectare. Rice production has developed more or less spontaneously in the many small basins or bottom lands, or in areas where the flow of temporary streams is impeded by roads. In none of these areas is there any control over water levels.

24. Cultivation of rice by irrigation is a much more recent development. It has been tried in a few small areas (Boulby, Louda, Mogtedo, Kamboinse) covering a total of about 300 hectares. Very good yields have been obtained in the areas developed by the Chinese mission (Boulby and Louda), averaging about 6 tons per hectare during a period of 3 years and even reaching 7 tons per hectare in 1969 on an experimental plot of 2 hectares at Louda. These excellent results are due to the attention paid to the levelling and preparation of the land and the thorough training and assistance given to the farmers. It should also be noted that the farmers in these two areas were organized into cooperatives both for field work and for marketing. It will be interesting to see what happens to these schemes after the departure of the Chinese mission, and particularly whether the high yields are maintained. At Mogtedo and Kamboinse the farmers have not had the same intensive training and advice, and the yield is not so good, although it is still high: 3.5 tons per hectare. It is to be noted also that certain large rice projects, dating from several years back (as at Loumana and Niena-Donkele) have yielded little or no output either because there was not sufficient manpower or because the irrigation infrastructure has not been finished.

25. The rise is sown directly in the rice fields, either broadcast, or more often, in pockets using the same method as for sorghum. The sowing is done after the advent of the rainy season, and after the land is wet enough to be worked with the hoe. There are frequent crop failures since there is no control of flooding; if flooding occurs too soon or is too severe the young plants may be drowned, and if the rain stops prematurely the rice paddies dry up and the plants fail to mature, particularly when there is a long maturation period. Husking is often done by parboiling on the farm; this method has the advantage of increasing the nutritional value of the product, but it demands a great deal of work. Rice is usually consumed on the farm or is marketed through traditional channels after this rudimentary treatment. Only a small part of the production (about 2,000 tons) is delivered to the modern rice mill of SISALIA, which is not working at full capcity.

26. Only rough estimates are available on the total supply of food grains. The quantity of sorghum and millet available for each inhabitant is of the order of 170 kilograms a year, excluding seed grain and losses. If the amount used for beer is deducted, this leaves 150 kg of sorghum and millet per inhabitant in the form of food grains. To this must be added maize, rice and imported wheat flour. The latter is used in increasing quantity in the towns: in 1968 imports amounted to CFAF 40 million, i.e. about 13,000 tons, three times the quantity of rice. The total supply of cereals (sorghum + millet + maize + rice + imported flour, after deducting seed grain, losses, and sorghum and maize used for beer) can be estimated at about 180 kilograms annually per inhabitant, of which 3.5 kg represent imported cereals.

Cash Crops

27. Cotton, groundnuts and sesame, occupying an area of about 250,000 hectares, account for most of the products marketed through the modern sector with a view to export or industrial processing locally (oils and, after 1970, textiles). To these products should be added sheanuts picked from wild trees. 1/

28. Cotton is the principal cash crop in Upper Volta. Production has made spectacular strides between 1961/62 and 1968/69. In eight seasons, the area under cultivation has multiplied by 3.3; the volume of seed cotton marketed has multiplied by 13, and the yield has gone from 102 kg per hectare in 1961/62 to 426 kg per hectare in 1968/69. The average yield over the last three seasons has been about 330 kg per hectare.

Table 1: DEVELOPMENT OF COTTON PRODUCTION AND YIELDS

	Area ('000 ha.)	Production of cotton seed ('000 tons)	yield kg/hectare	Production of fibers ('000 tons)
1961/62	22.9	2.4	102	0.8
1962/63	36.0	6.6	184	2.2
1963/64	45.8	8.0	176	2.7
1964/65	52.5	8.8	167	3.0
1965/66	49.7	7.5	150	2.5
1966/67	52.3	16.3	311	5.7
1967/68	65.4	17.3	264	6.2
1968/69	75.0	32.0	426	11.4
1969/70	84.0	36.3	431	

Source: CFDT

1/ See Annex 1 - Table III: Changes in volume and direction of sales.

These excellent results are the fruit of the policies adopted by the CFDT, whose methods will be examined later.

29. Production is chiefly for export, in the form of fibers and seed. Cotton represented 20 percent of the total exports of Upper Volta in 1968.

Table 2: PRODUCTION AND EXPORTS OF COTTON FIBER AND SEED

	1965	1966	1967	1968	1969
Production of cotton fiber ('000 tons)	2.3	2.5	5.7	6.2	8.7
Value of exports of cotton fiber (CFAF millions)	257.2	303.5	842.0	913.5	-
Value of exports of cotton seed (CFAF millions)	47.5	32.3	97.8	123.5	-

Source: CFDT and Department of Commerce.

30. A small part of the production (about 3,000 tons cotton seed) falls outside the modern sector and supplies an active artisanal textile industry. The opening in 1970 of the Voltex factory (with an ultimate opening capacity of 2,500 tons), which is intended to supply the home market, may, however, rapidly reduce the output of traditional textiles. Cottonseed production in Upper Volta may also undergo a considerable transformation if CITEC builds a new oil mill capable of processing 20,000 tons, including 15,000 tons of cotton seed.

31. The cotton producing areas are mainly in the Black Volta, Bobo-Dioulasso and Koudougou regions.

Table 3: REGIONAL DISTRIBUTION OF COTTON PRODUCTION
(1968/69 season: - in thousand of tons)

	'000 tons	%	Cumulative %
Black Volta ORD /a	17.11	53	53
Koudougou ORD	5.73)	33)	86
Kaya ORD	4.87)	)	
Bobo-Dioulasso Sector	2.11)	11.5)	97.5
	)	)	
Ouagadougou ORD	1.61)	)	
Yatenga ORD	0.77)	)	
Koupela Sector	0.16)	)	
Gaoua Sector	0.14)	2.5)	100.0
Eastern zones	0.07)	)	
Banfora ORD	0.03	)	
Total for Upper Volta	32.60	100.0	

/a The Regional Development Offices (ORD's) are independent specialized agencies responsible for the integrated rural development of each region and supplied with funds and staff for this purpose.

Source: CFDT reports.

32. There is little reliable information about the total volume of groundnut production in Upper Volta: It is estimated at about 75,000 tons of groundnuts in the shell. The area under cultivation is said to be about 100,000 hectares and the average yield about 700 kilograms per hectare. Most of the production is intended for local consumption (between 55,000 and 60,000 tons). It is believed that production as a whole has kept pace with consumption, increasing at a rate of about 2% per annum. A proportion of the production, constantly increasing since 1960, is marketed through the modern sector: a quota of the order of 3,000 tons in the shell is allotted to industry (CITEC) for the production of 900 tons of refined oil (600 tons for the domestic market and 300 tons for export); the remainder of the marketed production is exported shelled. Until 1959 these exports remained more or less stationary, never exceeding 3,000 tons of shelled groundnuts, and from 1960 to 1962 they actually fell off; since then, however, they have steadily increased in spite of marketing problems. A total of 8,800 tons of shelled nuts was reached in 1968, representing 6% of the total value of exports in that year. The production areas are in the West (Banfora, Bobo, Diebougou) and in the East (Bogande, Kongoussi).

Table 4: EXPORTS OF GROUNDNUTS AND GROUNDNUT CAKE

	1965	1966	1967	1968
Exports of shelled groundnuts ('000 tons)	4.3	5.8	7.4	8.8
Value of exports of shelled groundnuts and oilseed cake ('000 million)	168	217	302	311

33. The output of sesame is not very large (some 6,000 tons). The crop is grown mainly in the regions around Bobo-Dioulasso, Banfora, and in Black Volta, covering approximately 35,000 ha. in all. About half the crop is consumed locally, mainly for making Sombala sauce. The other half (2,900 tons in 1968) is exported through the modern sector. Sesame represents 2.5 percent of exports, with a contribution of CFAF 118 million.

34. Sheanuts grow widely in Upper Volta. The nut harvest varies rather widely, however, because of the fruiting cycle of the tree, as can be seen in the figures for quantities sold for the past 12 years. In 1966 Upper Volta had a good crop year and a special trading advantage arising from the troubles in Nigeria. These circumstances made it possible to export 16,000 tons of sheanut kernels to Scandinavia and Japan at a satisfactory price. In 1968 the value of sheanut kernel exports amounted to CFAF 310 million, representing 6 percent of the value of all exports, roughly the same percentage as groundnuts. The local industry, which receives a fixed proportion of exports (3,266 tons in 1968) produces sheanut butter, some of which is exported. The consumption of sheanut butter in the traditional sector is large, but there is no way of measuring it.

Table 5: QUANTITIES OF SHEANUTS SOLD ('000 tons)

1956	6.1	1960	13.9	1964	15.2
1957	2.6	1961	1.8	1965	1.5
1958	2.7	1962	14.1	1966	18.0
1959	1.5	1963	0.5	1967	0
				1968	20.8

Marketing and Prices

35. Minimum prices are fixed by government order for each crop at the beginning of the season. While these prices are adhered to for crops sold through the modern sector, they are treated as no more than guidelines for subsistence crops sold through the traditional sector. During the past five years the only producer prices that have changed are those for cotton and groundnuts, for which prices fell for the 1968/69 and 1969/70 crop years.

Table 6: PRODUCER PRICES FOR VARIOUS CROPS

	1967/68		CFAF per kg 1968/69 & 1969/70
Sorghum/millet	12		12
Corn	13	(prices	13
Rice, 1st grade	19	unchanged)	19
Rice, 2nd grade	17		17
Sesame (Ouagadougou)	26.75		26.75
Sheanut (Ouagadougou)	7		7
Groundnuts, shelled (Ouagadougou)	26.75		25.75
Seedcotton, 1st grade	34	(prices	32
Seedcotton, 2nd grade	30	lower)	28

The minimum prices for sheanuts, sesame and groundnuts include transport costs, an arrangement that is to the disadvantage of remote districts. If the price is 100 around Banfora and Bobo-Dioulasso, it is 80 to 85 around Ouagadougou, Koudougou and Kaya, and 75 to 80 around Ouahigouya and Dedougou. The minimum price for cotton, on the other hand, is standard for the whole country.

36. Except for cotton, the government's marketing policy has vacillated, sometimes giving a monopoly to the ORDs, sometimes sharing the marketing with private traders. Currently, cotton is marketed as a government monopoly by the CFDT. The crop is purchased directly by the ORDs where there are extension services, and by the CFDT in the areas without extension services. On the other hand, the Ouagadougou, Kaya, Koudougou, Fada N'Gourma, Dedougou and Koupela ORDs have had to abandon their monopoly for groundnuts, sesame and sheanuts to approved dealers of whom there are forty-nine. Similar dealers also handle purchases in the ORDs where there are no extension services. Thus, in the area around Bobo-Dioulasso, which produces large quantities of groundnuts and sesame, the IRHO, which provides extension services for a substantial number of oilseed growers, is in competition with private buyers, who have at least some backing from the industry. Only the Ouahigouya and Banfora ORDs, where production is greatest, have a monopoly of purchases from the farmers; they may, however, arrange for the purchasing to be done by private traders.

37. The disposal of the groundnut, cotton and sheanut crops to the processing industry is regulated by the Price Stabilization Fund 1/, established in 1964. The Fund is financed by a tax on imports and exports, by a levy on sales of groundnut oil in Upper Volta, by refunds by exporters when actual prices are above the prices fixed by the Fund, and by other sources. Both management and operation are satisfactory. The main crop supported by the Fund is cotton. The price paid to the farmer for this crop is so high that taking ginning and transport costs into account, it cannot be sold at the world market price without the Fund's support. Groundnut prices have also been heavily subsidized since France stopped guaranteeing the price in 1968. However, both sesame and groundnut exporters returned money to the Fund in 1967/68 and 1968/69 when the world prices for both these crops were good. The Fund's positive balance at the end of the 1968/69 crop year was CFAF 340 million. While cotton fibre is marketed by CFDT, oilseed products are exported by private traders, who are, however, obliged to deliver a proportion of their sales to the CITEC oil mill.

38. The other crops receive no market support. Rice is delivered to the Siselia mill. SOVOLCOM 2/ tried to organize a cooperative marketing scheme, but poor management led to a suspension of the operation. SOVOLCOM mismanaged a stock of cereals which it had received from the World Food Program for the purpose of stabilizing grain prices. Although this scheme failed, stabilization as an objective would be worth pursuing. It was in fact successful over a two-year period in the Yatenga ORD.

C. Conclusions

39. The following conclusions may be drawn from this analysis of agricultural production in Upper Volta:

> The food problem does not appear to have been aggravated as yet by population pressure. That does not mean that there has been a notable improvement either, particularly in the traditional period of shortage just before a new harvest. The area under cultivation has increased and that under fallow has diminished without any increase in yields.
>
> Cotton has become the major industrial crop in Upper Volta, and production has increased even beyond expectations. The future looks good despite the marketing risk resulting from the simultaneous expansion of production by a large number of African countries.

1/ See Annex 1, Tables IV and V.

2/ Societe Voltaique de la Commercialisation (Upper Volta Marketing Corporation).

Several crops like groundnuts and sheanuts have been expanding regularly, but they are subject to fluctuations arising from short-term economic and political developments (e.g. the Nigerian crisis).

Rice is being consumed more and more commonly, and rice production is increasing.

Human diets in Upper Volta are still deficient in animal protein.

Upper Volta still does not produce two items, sugar and cola nuts, that account for a substantial proportion of imports. Imports of sugar, which could be grown in Upper Volta, amount to CFAF 594 million per year. Cola nut imports amount to CFAF 599 million, or perhaps more since many nuts enter the country through uncontrolled channels. The value of these two items together comes to 21 percent of the value of exports in 1968, i.e. more than the income from exports of cotton.

40. So far as production is concerned, it is clear that agriculture is subject to serious constraints -- by poverty of the soil and the erratic nature of the rainfall. The rather rudimentary techniques currently in use are also conducive to low yields and make possible only extensive methods of cultivation. The effect of ecological constraints is aggravated by the uneven distribution of the population. In the areas of very dense population, like the Mossi Plateau with its 40 people per km^2, it is no longer possible to enforce four-year rotations. The more skilled peasant farmers, like those on Yatenga, have been spurred by the increasing pressure of population to intensify their cropping and to use more fertilizer. However, in most of the over-populated areas, the worked-out soils have become impoverished and the people have begun to move away.

41. The migratory movements are of two sorts, temporary and permanent. The temporary migrants are mainly young men who go to work in Ivory Coast or Ghana, where they are the mainstay of commercial agriculture and the building industry, among other activities. On their return to Upper Volta, they bring back, in money and in kind, CFAF 2 billion per year. Yet the numbers of migrant workers are still not accurately known; nor are the routes or the duration of their migrations. The second type of migration is more far-reaching, if less spectacular. What is in fact happening is that Mossi families are slowly but steadily moving into the less densely populated areas occupied by other racial groups in the Southwest and the East of the country. Little is known about this flow of Mossis away from their homeland. It would seem wise to try to direct the movement toward certain selected areas, both in order to make better permanent use of the empty parts of the country and to keep an undue concentration of immigrants from upsetting the existing social and political equilibrium.

II. AGRICULTURAL DEVELOPMENT: POLICIES AND RESULTS

A. Development Programs and Institutions

Development Programs

42. For the past decade the main features of agricultural development in Upper Volta have been the variety of methods attempted and the occasional lack of coordination between them. However, the establishment of Regional Development Offices (ORDs) and the 1967-70 Development Plan facilitated a reorganization of activities along more systematic lines and the first steps toward a development policy.

43. An ORD is a decentralized agency, administered by a Board of Directors, that is responsible for formulating and implementing development projects within its region. The role of the Rural Development Department in the Ministry of Agriculture is virtually restricted to preparing budgets and supervising their execution, and to personnel administration.

44. Under existing development policy the execution of programs on a regional basis is delegated to the ORDs, operating under the control of the Ministry of Planning and the Ministry of Agriculture. Principal ORDs operations that have been established have had the benefit of financial support from abroad, the Banfora and Yatenga ORDs from FED, and the Volta Noire, Kaya, Ouagadougou and Koudougou ORDs from FAC, as well as foreign technical assistance. The latter is handled by foreign companies ("Societe d'intervention") which are responsible for carrying out the program, organizing the extension services and the progressive Voltaization of the ORDs. A number of companies, including SATEC, BDPA, SOTESA, CFDT and CIDR, have received contracts to assist ORDs in this way. It will be noted that in principle the ORDs are only activated when they are assured both financing from abroad and the provision of technical assistance by a foreign agency. The ORDs at Fada N'Gourma and Koupela, for instance, exist only on paper. The ORD of Gaoua is an exception to the rule as it obtains technical assistance from CIDR but is financed out of the budget of Upper Volta.

45. The main efforts of the ORD's focus on farmers' education through the provision of an extension service ("encadrement rapproche") and the propagation of progressively more sophisticated methods of cultivation ("themes techniques progressifs"). The methods vary from company to company. CFDT concentrates largely on cotton, while SATEC and BDPA seek to transform the farm enterprise as a whole. CIDR is trying to organize agricultural producers into groups. Despite these variations, however, the basic principles are the same for all, and the main lines of action may be summarized as:

establishment of a network of agricultural extension workers;

distribution of short-term credit for seeds, fertilizer, and insecticide; and of medium-term credit for the purchse of cultivating equipment, carts, draft animals and sprayers;

provision of technical advice (timing agricultural operations; sowing in line; use of draft animals; methods of spraying and fertilizing, etc.);

marketing cash crops;

provision of rural infrastructure (roads, wells, dams) in collaboration with the Department of Water and Rural Equipment and the Department of Public Works, although it should be noted that this type of work is seldom under the direct responsibility of the ORDs.

46. This organization of agricultural development, despite its apparently rational character, has a number of weaknesses. In the first place, it deprives the Government of part of its control over agricultural development, which is in fact in the hands of agencies or services that determine the basic orientation of the ORDs. This excessive independence of the regional bodies weakens the effectiveness of the Ministry of Agriculture, with respect to both substance and policy. As to the actual work of the ORDs, it is clear that efforts have mainly been devoted to agricultural extension work and that little has been done for livestock or agricultural equipment. Thus, most of the available funds have been used to cover the recurrent costs of educating the farmers. The future of the ORDs is still uncertain: financing, which is still foreign, is by no means assured, especially since the results achieved are as yet insufficient to support the cost. The withdrawal of the financing of SATEC's operations in the ORD of Ouagadougou is a case in point. Finally, it should be noted that the ORDs and the "societes d'intervention" require large numbers of supervisory and local counterpart staff, the cost of which has to be borne by the domestic budget. The lack of any plan for training senior and middle-grade staff for work in rural areas to replace the foreign experts at less expense, makes it very difficult to cut the cost or to expand the scale of the operations of the ORDs.

The Resources of the Ministry of Agriculture

47. The Ministry of Agriculture consists of four departments: Rural Development, Water Resources and Rural Equipment; Livestock and Animal Industries; and Water and Forests. Its budget rose from CFAF 80 million in 1957 to CFAF 415 million in 1969. The share of agriculture in the ordinary budget amounted to 2.7 percent in 1957 and 5 percent in 1969. In 1969, the Department of Rural Development had a budget of CFAF 176.9 million and the Department of Water Resources and Rural Equipment one of CFAF 26.6 million.

The Ministry's staff has increased substantially in recent years. In 1957 the staff of the Ministry totalled 185, of whom 35 were expatriates. In 1966 the Department of Rural Development had a staff of 644, all local citizens, of whom some were seconded for service with the ORDs. To these must be added foreign technical assistance personnel and ORD staff members that are not paid out of the government budget. Among these there are 650 farm-level extension workers, who are paid mainly by the ORDs.

The Regional Development Offices (ORDs)

48. Since 1966, when ORDs were first brought into existence, Upper Volta has established seven of them. Several of these have received financing from abroad, enabling them to start work. The seven are listed below:

ORD Volta Noire (Dedougou) - Agency: CFDT
Financing: FAC - Bank group financing under consideration.

ORD Ouagadougou - Agency: SATEC 1/
Voltaic since 1968
Financing: FAC

ORD Koudougou - Agency: SATEC
Financing: FAC

ORD Kaya - Agency: CFDT
Financing: FAC

ORD Banfora - Agency: SOTESA
Financing: FED

ORD Yatenga (Ouahigouya) - Agency: BDPA
Financing: FED

ORD Gaoua - Agency: CIDR
Financing: Government budget.

Two other ORDs of Koupela and Fada N'Gourma have been established but have not been activated. It is intended to establish two other ORDs, one at Bobo-Dioulasso, the other for the Sahelian region of the North (ORD du Sahel) at Dori.

49. The unusual characteristics of the areas served by the ORDs are briefly described in Table 7:

1/ SATEC plays only an advisory role at present.

Table 7: CHARACTERISTICS OF THE ORDs

ORD	Area sq.km	Total population (1970)	Density of population inhb./km2	Annual rainfall mm	Potential
Ouagadougou	24,179	755,000	31	750-1000	Small; soils overworked
Koudougou	26,324	685,950	26	800-1000	Small in areas that are little exploited; mediocre in others owing to climate and soil conditions
Kaya	21,578	558,000	26	650-800	Small; climate very dry; soil overworked
Ouahigouya	12,300	504,000	41	600-700	Very poor; soil overworked; climate poor
Dedougou	27,356	545,900	15	800-1100	Fair; soil quite good, but climate rather dry in the North
Bobo-Dioulasso	20,500	269,000	13	1100-1200	Fairly good; rainfall quite high
Banfora	18,393	203,600	11	1200-1400	Good; climate favorable; some soils good
Diebougou-Gaoua	14,488	157,300	11	1000-1200	Fairly good; climate and soils relatively favorable
Koupela	15,657	333,300	21	700-1000	Small, owing to low rainfall and overworked soils in some areas
Fada-N'Gourma	43,444	202,750	5	700-1000	Mediocre, owing to climatic conditions

ORD Policies

50. The delegation of powers to the ORDs has a number of advantages. By bringing decision-making closer to the farmers it has been possible to take account of local problems; agricultural developments are handled more actively and with less red tape; the officers responsible for rural affairs are in closer contact with the farmers, who thus enjoy much more effective assistance in terms of advice and supplies assistance than would otherwise be the case. But the transfer of responsibility away from the center has also brought a number of difficulties in its train. The lack of qualified senior staff and funds has made it impossible to build up a strong team in the Ministry. The latter is unable to maintain proper coordination, or technical and financial control, as it is supposed to do. There is no single source of complete up-to-date information on agricultural activity in the country. The country's agricultural statistics, which had never been very complete, are now either almost non-existent or only produced very late. Activities which cannot be shown to justify the presence of a full-time officer in each ORD are not undertaken.

51. An outstanding example of the advantage of centralizing certain activities is the success of the nation-wide seed protection campaign; FED financed a team whose function was to popularize disinfection of seed throughout the country by means of posters and film shows. The ORDs distributed the necessary material. The result of this activity by a team whose work was well coordinated with that of the ORDs was the distribution of nearly 250,000 packets of thiolal by the farmers.

The Ouahigouya ORD (BDPA)

52. The Ouahigouya ORD is responsible for an area of 12,300 sq kms and a population of 504,000. The average density is 41 persons per sq km, but actual density is over 70 in the most densely populated areas. The soil is very poor, the laterite pan being often very near the surface. Annual rainfall is between 600 and 700 mm. The soil and climate are therefore unfavorable to agriculture, which consists principally of subsistence farming (millet), and the production of very small quantities of export crops (groundnuts, sesame and cotton). Both herdsmen and cultivators possess a large number of animals (cows, sheep and goats). The average farm family consists of eight people and cultivates 2.8 ha. of grain and 0.4 ha. of land devoted to export crops. The average yields are about 550 kg/ha. for millet, 400 kg/ha. for groundnuts, 200 kg/ha. for sesame and 100 kg/ha. for cotton.

53. In March 1965 the BDPA was put in charge of an agricultural development program in the area in which the European Soil Restoration Group (GERES) had previously carried out anti-erosion work (2,540 sq kms; pop. 158,000). In April 1967 its contract was extended to cover the whole area under the Yatenga ORD (established in 1966; directed by Voltaic since September 1968). The work, financed by the FED, has focused on the propagation of the following methods of cultivation for millet, groundnuts, sesame and cotton:

improvement of sowing (seed treatment, selection of quick-growing varieties, proper density, sowing in line);

improvement of cultivation (land preparation and weeding) using draft animals;

use of chemical fertilizer;

parasite control (in grain silos and on cotton).

54. In addition to extension services, the ORD provides farmers with supplies and equipment, helps them to market millet, groundnuts, cotton and small livestock. It has also undertaken a limited livestock program (provision of salt and disease control). FED has financed 78 wells, with some contribution from the beneficiaries.

55. A new plan has been prepared for the period 1970-73. It not only continues existing activities, but provides for an expanded livestock program envisaging the organization of stockbreeders into groups to make better use of their herds and flocks, better control of parasites, more national use of grazing land and watering points for cattle.

56. The results so far have been good on the whole, but the farmers are so poor that they cannot be expected to make very spectacular progress in such an unpromising milieu. The ORD's program is primarily social in character, designed to palliate the serious problems facing this over-populated area; it can hardly be considered as a means of achieving a high level of productivity, something that the nature of the area will hardly permit.

The Koudougou and Ouagadougou ORDs (SATEC)

57. The Koudougou and Ouagadougou ORDs together are responsible for an area of 50,500 sq kms and a population of 1,353,000. The average density is 27 per sq km, but actual density reaches 100 per sq km. in some areas. There is so little fallow that soil fertility is constantly declining. Rainfall varies from 750 to 1000 mm per year. Neither soil nor climate are very favorable for crops, which consist mainly of sorghum and millet, with some areas under groundnuts and cotton. The average family unit consists of about 9 people farming roughly 3 ha of which 2.6 ha are under subsistence crop, and 0.4 ha under cotton and groundnuts, with a little rice in bottom lands. Each family has on average 2 head of cattle. Average yields are said to be 500 kg/ha for sorghum, 450 kg/ha for millet, 200 kg/ha for cotton and 400 kg/ha for groundnuts.

58. The area of the Ouagadougou ORD is even more over-populated than that of the Koudougou ORD. This disparity is all the more serious because the poverty of soils in the Ouagadougou makes it impossible to envisage the development of cotton and groundnuts production. The Koudougou area, on the other hand, has considerable potential for cotton and many bottom lands

are suitable for rice-growing. This all goes to explain why the Koudougou ORD has been making relatively satisfactory progress, while rural development has been very slow in the Ouagadougou area and will remain so. The difference in the rate of development of these two areas is likely to increase in the future, even despite the roughly equal efforts of the extension services hitherto.

59. In January 1961 SATEC was put in charge of the first extension program which was later extended to cover the whole area of the two ORDs, which were set up in 1966. The Ouagadougou ORD has been run by a Voltaic since 1967. Financing is provided by FAC. At first efforts were concentrated on raising the output of subsistence crops by introducing donkey-drawn cultivators for land preparation and weeding. A "basic" application of phosphates and continuing applications of nitrogen-phosphate fertilizers were advocated. While a substantial number of cultivators were sold on credit over a four-year period, the area actually cultivated with this equipment has remained very limited and the additional output due to the use of fertilizer has been rather small. As the subsistence crops are not marketed, the farmers have been unable to repay the loans they contracted. Since 1966 the ORDs have restricted their efforts almost entirely to cash crops (groundnuts, and particularly cotton), concentrating in the:

improvement of sowing (seed treatment, selection of quick-maturing varieties, proper density);

improvement of cultivation techniques (land preparation and weeding), using animal-drawn cultivators;

parasite control on cotton and in grain stores.

60. The ORDs also provide farmers with equipment (hoes, sprayers), supplies (fertilizer and insecticides and seed). They are responsible for marketing the cotton for the account of the CFDT, which has a monopoly of the crop. They make short-term loans on their own account, thanks to an advance from the BND. Results have been good insofar as cotton is concerned; output has risen particularly in the area of the Koudougou ORD, where conditions are quite favorable. The present work will be continued, and efforts will be made to encourage rice-growing in the bottom lands and in irrigated areas.

The Black Volta and Kaya ORDs (CFDT)

61. The Black Volta ORD (Dedougou) is responsible for an area of 37,000 sq km with a population of 512,000. The average density is fairly low - 14 per sq km. Rainfall is about 950 mm per year. Only 7 percent of the cultivable area is under crops. The Black Volta is the main cotton-growing area of Upper Volta.

62. The North Mossi ORD (Kaya) is responsible for an area of 21,000 sq km. The population is 530,000 and the density 26 per sq km. Rainfall

is about 700 mm per year. Eleven percent of the area is cultivated. There are between 7 and 8 ha of pasture for every head of cattle.

63. Extension services in the areas of these two ORDs are provided by the CFDT (with the assistance of the CIDR at Hounde and Boromo). So far, efforts have been concentrated on cotton, with the emphasis on spraying, use of fertilizers and sowing in rows. The areas of the two ORDs together currently produce 70 percent of all the cotton grown in Upper Volta. Both ORDs have been financed by the FAC.

64. The Black Volta ORD has been described in detail in a project for developing the area's cotton production which was prepared in connection with a request for financing by the World Bank Group. The plan also covers the area of the future Bobo-Dioulasso ORD.

The Other ORDs 1/

65. Since 1968 the Banfora ORD has been financed by FED and has had the technical assistance of SOTESA, an Italian company. The ORD is mainly concerned with the development of the oilseed crops (groundnuts and sesame) in which the IRHO has been taking an interest since 1967. It will expand its activities to take in rice-growing in bottom lands.

66. The Gaoua ORD has access to limited funds from the national budget. Extension services are provided by the CIDR. The establishment of the ORD has made it possible to introduce cotton-growing in this area. However, CIDR is seeking to bring about a more comprehensive change in the agricultural organization of the area. Interesting work, though on a rather small scale has been undertaken to establish cooperatives, set up stores, and regroup land-holdings. It is apparently intended to entrust the extension work in the ORDs of the South-East (Koupela and Fada N'Gourma) to the CIDR when funds become available.

67. Mention must also be made of the work of the IRHO in the Bobo-Dioulasso area, which is being organized as an ORD. The IRHO seems to have had considerable success in extension work with groundnut producers, even though extension is not its real function. The new Bobo-Dioulasso ORD will be entrusted to CFDT, and is included in the development plan prepared for financing by the World Bank Group.

Agricultural Credit

68. Agricultural credit is made available by the National Development Bank (BND) through the ORDs which examine requests for loans and are respon-

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1/ Banfora ORD (18,400 sq km) Pop. 190,000
South-East ORD (59,000 sq km) Pop. 510,000
Bobo-Dioulasso (20,500 sq km) Pop. 255,000
Gaoua ORD (14,500 sq km) Pop. 146,000

sible for obtaining reimbursement. In the three-year period 1966-69 the volume of credit made available exceeded one billion CFA francs. Most of the loans have been short-term; they have been granted for marketing (53 percent of the total, 1966-69), and for purchases of fertilizers and insecticides (28 percent, 1966-69). Medium-term credit amounted to only 19 percent of the total in 1966-69. Most medium-term credit is granted to enable farmers to buy animal-drawn cultivation equipment and insecticide sprayers.

69. The recovery of credit has been rather difficult in certain regions. More than half the total payments due in the country as a whole were not recovered between 1966 and 1968. The situation improved when the authorities began repossessing the equipment of defaulting farmers. There has also been some improvement as the result of rising farm incomes from cotton. The need to improve the financial situation has, however, led to a major change in extension work; in particular, SATEC has had to abandon its efforts to introduce animal-drawn equipment. Table VII, prepared before the repossession of equipment, shows that 90 percent of the arrears were concentrated in the areas where SATEC provided extension services. These areas, some of which--like that of the Ouagadougou ORD--suffer from unfavorable natural conditions, have been unable to produce a sufficient additional volume of cash crops to enable farmers to repay the loans on a regular basis. On the other hand, in the areas entrusted to the CIDR, reimbursement amounted to 100 percent in 1968. Reimbursement has also been good in the ORDs where CFDT has been providing the extension services. 1/

Extension Services

Organization and Methods

70. The number of extension personnel engaged by the various agencies in 1968-1969 is shown in Table 8.

1/ See Annex 1: Table VI: Agricultural Credit 1966-69; and Table VII; Status of Payment, June 1968.

Table 8: EXTENSION PERSONNEL BY ORD

Agency	Sector Leaders	Subsector Leaders	Farm-level Workers
CFDT			
- Black Volta ORD	7	19	134
- Kaya ORD	4	8	47
- Bobo-Dioulasso Cotton Sector	1	-	9
- Koupela Sector	-	1	3
BDPA - Yatenga ORD	6	-	73
CIDR - Gaoua ORD	3	11	33
SATEC			
- Koudougou ORD	15	-	130
- Ouagadougou	15	-	140
SOTESA			
- Banfora ORD	n.a.	n.a.	56
IRHO			
- Bobo-Dioulasso	-	-	10 /a

/a Plus 38 unpaid assistants.

71. All the ORDs and the CIDR in the Dano-Gaoua area have set up similar organizations. However, the hierarchical structure varies very greatly, particularly in terms of the number of staff for which an officer at one grade is directly responsible. (See Table 9).

Table 9: HIERARCHIC STRUCTURE OF EXTENSION STAFF

	BDPA		CFDT	SATEC	CIDR
	Up to end 1969	From 1970			
ORD Director					
No. of subordinate sector leaders	6	6	7	4	6
Sector Leaders					
No. of subordinate subsector Leaders		2.5	3.6	4	4
Subsector Leaders					
No. of subordinate extension workers	11	3	6	8	4
Farm-level extension workers					
No. of farms in charge	80	80	130	100	130

Note: Organization on the basis of personnel strengths in November 1969. The data in the table above, provided by the ORDs, sometimes differ from the official figures in the preceding table.

The ratios are low (2.5 to 7) at the higher echelons and high (80 to 130) at the lower echelons. The ratio of senior grades to farm-level extension workers is high (between 17 and 46 supervisors for every 100 extension workers). The percentage of farms assisted by the extension service in relation to the total also varies greatly from one ORD to another, the extremes being 5 percent in the newly formed Gaoua ORD and 35 percent in in the Black Volta ORD.

72. Depending on the agencies involved, the "animation" of farmers 1/ ranges from interesting farmers in growing cotton by modern methods to the creation of a general atmosphere in which farmers are prepared to accept modern methods not only in crop raising but also in other areas (CIDR). In addition the CIDR requires that its extension workers cultivate their own fields and make these among the best in the village as a condition of retaining their jobs. The CIDR insists that the example set by extension workers and the outstanding yields they obtain are the most effective way

1/ The present system is characterized by a confusion between "vulgarization" (extension) and "animation". The purpose of these two functions is described and discussed in the section of this report on training and education.

of "animating" farmers to make progress. In fact, to enable the CIDR extension officers to cultivate their own fields, they are often employed "part-time"; however, they are never unpaid volunteer workers, because such an arrangement would make it impossible to obtain organized consistent work from them. All the agencies carry on their extension work in the same manner. They discuss various techniques (row-cropping, spraying, etc.) at village meetings, usually accompanied by demonstrations. The demonstrations are repeated for the benefit of smaller groups, preferably with some of the farmers actually carrying out the technique described. Finally, advice is given to the heads of farm families who apply the technique on their own farms.

Training, Recruitment, Salary and Future of Extension Staff

73. BDPA and SATEC have succeeded in working out methods similar to those used in training professional staff for the training of farm-level extension workers and subsector leaders. CIDR believes that training is a matter of experience with problems on the spot. This method has given excellent results. CFDT has also been successful with the same approach.

74. Farm-level extension workers are either recruited locally, generally from among candidates who do not have a certificate of primary education (CEP) and trained by subsector chiefs on the spot, or selected by competition among holders of the CEP and given a nine-month training course at Matourkou. Senior officers agree that the officers recruited by the second extension workers selected in accordance with the second method generally lack practical experience and find it difficult to communicate with farmers because of their different social and, sometimes, racial origins. Their general and technical knowledge is not such as to offset these shortcomings. The CIDR holds the view that, after two years' work in the field, the locally recruited and trained personnel are more useful.

75. There are no set rules for recruiting the medium-grade officers (subsector leaders and sector leaders). They are usually former agents 1/ of the Rural Development Department (Agricultural Technical Assistants and Agricultural Project Leaders) lent to the ORDs. They have a reasonable amount of technical knowledge and their previous work has usually given them some familiarity with extension work. However, they are almost always short on practical experience and they are often accused of having a civil service outlook which is not at all desirable in their new jobs.

76. The CFDT, sometimes, and the CIDR, usually, try to find among their farm-level extension workers people capable of becoming successively subsector and sector chiefs through internal promotion. This procedure, which has always given good results in the cotton-growing areas assisted by the CFDT, cannot be easily applied in ORD's where officers transferred

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1/ Either agricultural assistants ("adjoints techniques agricoles", or ATA) or supervisors ("conducteurs des travaux agricoles", or CTA).

from the Rural Development Department make up much of the staff and tend to insist that posts at different grades should be held only by people with certain "paper" qualifications.

77. The CIDR believes that farm-level extension workers should after some time again become full-time farmers (they always retain their own farms) or take up work in institutions like agricultural cooperatives. The other agencies either have not faced up to this qustion, or have not come up with an answer.

78. There are very great differences in salaries between the extension workers and at the lowest end of the scale and the Directors of ORDs at the other. There are also great differences among the ORDs in the compensation of personnel. Thus CIDR pays its farm-level extension workers a net salary of CFAF 6,500 per month, while CFDT pays CFAF 17,000. Furthermore, the officers seconded from the Rural Development Department retain existing salary regardless of the post they occupy.

Achievements to Date

79. It is difficult to form an opinion on the results achieved because the factors affecting production vary from one ORD to the next, and the extension programs were started at different dates. All the ORDs and the CIDR measure their achievements by the increase in output obtained. The data used in this exercise bear only on commodities that are marketed, mainly cotton. They do not take into account the part of certain cash crops such as groundnuts and sesame that is not marketed, and ignore entirely any increase in the output of subsistence crops or livestock products. The progress reckoned in this way does show that there has been a substantial increase in output, but does not make it possible to judge whether a more fundamental transformation in the direction of integrated rural development is taking place.

80. Data on the percentage of all farms "assisted" (i.e. that have applied at least one of the suggested techniques) or farms "equipped" (i.e. that have acquired at least one piece of equipment enabling them to apply modern methods) would provide a useful indication of what has been achieved. But there is no detailed information on this point. Data supplied by the extension workers themselves indicate that each of them has on the average "assisted" between 80 and 100 farms and "equipped" about 10 farms. This would mean that between 10 percent and 40 percent of farms have been "assisted" and 2 percent to 3 percent "equipped", depending on the ORD.

81. If more detailed and accurate figures were available, it would be easier to locate the weak points and make suggestions for improvements. Only the CIDR has tried to find a solution to this problem by inviting the Adult Education Service of the CDPP to devise and apply a method for measur-

ing the effect of any given development action. The method has been tried out in the canton of Koper. 1/

Recruitment and Training of Voltaic Counterparts

82. Every expatriate officer employed by BDPA and CIDR either has a Voltaic counterpart, or advises one or more Voltaic officers who actually occupy supervisory posts. Despite some difficulty in finding suitable Voltaics, neither of these agencies has ever had to depart from this principle, which is in fact embodied in the statutes of the ORDs. Moreover, cooperation between the expatriates and the Voltaics is excellent at every level. SATEC has a Voltaic counterpart for its Director of the Koudougou ORD, but none for the sector leaders. There are no Voltaic counterparts for the CFDT staff.

Rural Education of Young Farmers

83. The rural education introduced in Upper Volta in 1961 shows an unusual degree of imagination and represents a very considerable gamble. It was designed to provide rural youths, in surroundings to which they are accustomed, with practical training that would enable them on their return home to give an impetus to the development of agriculture in their areas. This training is given by rural education instructors (male or female) in Rural Education Centers (CERs). The courses last three years and run consecutively.

84. Since this scheme started, some 650 centers have been opened and 25,000 students have received training, representing 7.6 percent of the population between the ages of 12 and 18 in a 3-year period. Nevertheless, the goals have not always been achieved. Only a small proportion of the students leaving CERs take an active part in working the family farm. While no statistics have been collected, all observers agree on this point. Many students on leaving the CER go on to Ivory Coast or Dahomey where they are employed on commercial farms or plantations. The main reasons for this partial failure are said to be the fact that the students are too young when they leave the Centers; the training does not fit them to work efficiently on a traditional farm; they have neither the funds nor the land to start a farm of their own if they wish; and both parents and students consider school (whether rural or any other sort) as a means of escape from the countryside.

1/ The method involves putting farmers in three categories according to their degree of acceptance of modern methods: (1) those using traditional methods; (2) those using modern methods; and (3) those using modern methods and also participating in cooperative activities. Changes within each category are noted each year, together with the age of the farmer. This method is, however, not very satisfactory because it is not based on any socio-economic classification, and it makes no provision for evaluating results. It is, moreover, a very laborious and costly method that would be difficult to apply generally.

B. Evaluation of the Programs

85. The Voltaic agricultural development program has provided part of the country with an extension service, tested and propagated certain measures to improve yields, encouraged production of cash crops, in particular cotton and groundnuts, and provided some infrastructure, principally in the field of water supply, though unfortunately at very great expense. Some of the results such as the increase in cotton output, mainly by raising yields, have been positive. However, there have also been some negative aspects such as high costs, unsuitable programs, and the failure to make use of water resources that have been developed.

Methods and Results

86. As the development programs have been in effect in the various ORDs for nearly ten years, it is possible to comment on the methods employed. The following are the main conclusions to be drawn:

the results vary greatly from program to program;

agricultural extension programs only begin to show results after a fairly long period;

the programs often do not take into account the economic and technical constraints to which farming is subject

Variations in Results

87. Cotton output has risen very considerably during the past five years, as has been noted previously. This remarkable increase is due to:

the profitability of the new techniques which are said to yield an income of about CFAF 200 for a day's work;

the effectiveness of the extension service;

the organization of the collection of cotton.

Table 10 shows the comparative results obtained in the various ORDs in the crop year 1968/69. The figures show both the success of the cotton program and the substantial margin for further improvement. Without increasing the number of extension personnel or the area under cotton, yields could be raised substantially by a more systematic application of various methods for raising productivity. However, the figures in Table 11 also demonstrate to what extent yields continue to be strongly affected by climatic factors. Thus in the Black Volta ORD the average yield in 1967/68 was below that for 1966/67 even though the area to which various "productivity measures" were applied was much larger.

Table 10: COTTON PRODUCTIVITY PROGRAMS, 1968/69

Regions	Area under cotton ha.	Proportion of area treated with insecticide (percent)		No. of sprayers per 100 ha. of cotton	Proportion of area fertilized (percent)	Fertilizer used per hectare (kg/ha)	Areas plant-ed in raws	Number of poly-cultivators per 100 ha of cotton	Proportion of area worked by poly-cultivators (percent)	Average yield (kg/ha)
		1 app.	2 app.							
Black Volta ORD (CFDT)	25,250	51	37	8.5	2.2	2.6	59	7.5	13.4	628
Kaya ORD (CFDT)	14,175	5	3	1.9	1.6	1.8	69	7.9	17.8	345
Bobo-Dioulasso Sector (CFDT)	6,685	13	10	4.6	6	6	13	4.6	10.2	313
Koupela Sector	2,135	1	-	0.4	1	1	85	4.0	2.5	76
Ouagadougou ORD	2,705	42	9.5	3.9	6.5	6	72	...	...	283
Koudougou ORD (SATEC)	13,220	37.5	17	2.7	8	8	75	...	...	433
Yatenga-Banfora-Gaoua ORDs	3,000	8	1.5	...	...	...	...	...	...	138
Total Upper Volta	71,650	31	18	5.0	12	11	60	...	...	447

Source: CFDT Report on 1968/69 Crop Year.

Table 11: DEVELOPMENT OF THE COTTON PRODUCTIVITY PROGRAM IN THE BLACK VOLTA ORD 1966-1969

	1966/67	1967/68	1968/69
Area under Cotton (ha)	16,715	22,476	27,250
Proportion treated with insecticide (percent):			
- 1 application	17.5	31.5	51.0
- 2 applications	8.0	15.8	37.0
Proportion manured (percent)	7.5	15.0	22.0
Fertilizer used per ha under cotton (kg per ha)	9.7	-	24.0
Proportion Planted in rows (percent)	-	52.8	59.0
Proportion worked by Poly-cultivators (percent)	11.0	8.8	13.4
Yield (kg per ha)	434	414	628

Source: CFDT Reports, 1966 - 1969.

88. Groundnut production has also increased, but not as rapidly as that of cotton, doubling between 1964 and 1967. The regional programs for the development of groundnuts have been quite successful when groundnuts were the only source of cash income. Everywhere else groundnuts have been unable to compete with cotton because the income it yields per man-day of labor, even in the most favorable circumstances, is no more than CFAF 100-400 and well below that of cotton. Marketing difficulties also seem to have made this crop less attractive to farmers. Nevertheless, the efforts made by IRHO have resulted in an important increase in the volume of groundnuts marketed in the Bobo-Dioulasso area.

Table 12: VOLUME OF GROUNDNUTS MARKETED
(Tons)

Year	Banfora	Bobo-Dioulasso (IRHO)
1960	64	-
1961	349	-
1962	1142	-
1963	1502	-
1964	979	233
1965	1228	724
1966	1274	1055
1967	1150	1063

89. On the other hand, attempts to improve yield of subsistence crops have had very limited success. The Ouagadougou and Koudougou ORDs both set up programs to raise the output of sorghum by improving land preparation through the use of donkey-drawn plows and chemical fertilizers. The program was a failure because the techniques offered did not raise output much and, since the crops were not sold for cash, the additional yield did not generate any income from which farmers could meet the extra expenses for the purchase of fertilizer, equipment and draft animals. When cotton was introduced in the area of the Koudougou ORD, it caught on as well as it had done in the other parts of Upper Volta. Indeed, it largely took the place of groundnuts.

Table 13: PRODUCTIVITY PROGRAM - KOUDOUGOU ORD

	1965	1966	1967	1968
Area under grain fertilized (ha)	104	84	32	...
Total number of cultivators	2440	2570	2322	2379
Number of cultivators used				1556
Area under groundnuts fertilized (ha)	38	158	95	40
Area under cotton fertilized (ha)	18	205	707	1051
Area under cotton treated with insecticide (ha)	163	1036	3543	4966
Cotton marketed (tons)	1354	3113	3070	5726

Source: SATEC

90. A comparison of the various programs shows that success depends on a certain number of factors:

It is essential to start by ascertaining which crops are likely to be profitable for the farmers.

The techniques that are to be propagated by the extension service must be developed by agricultural research and then tested under local conditions to determine whether they are likely to be profitable and whether they can be applied by local farmers.

The extension staff must be able to help the farmers use the new techniques, mainly by giving them the proper training.

Supplies and equipment suited to local conditions must be made available to the farmers at the proper time.

The various extension, supply and marketing activities must be properly organized and coordinated.

Slow Progress of Agricultural Extension

91. If they are to increase their output, farmers must use new methods. At certain times the traditional methods take up all the available labor for land preparation and the first weeding; and it is virtually impossible to increase the area under cultivation, even in those areas where the density of population is high, without changing the methods of cultivation. Education is therefore fundamental for the success of any development program.

92. The needed basic change is bound to take a long time. It is not easy to persuade farmers to abandon methods they have always practised since childhood. They have to be able to see for themselves the advantages of the new methods proposed. Variations in yield caused by irregular rainfall tend to hide the effects of technical change, especially if the additional output is rather small. The greater the change that it is desired to bring about, the longer the education process will take. Consequently, the duration of a program, and hence its cost, will be in inverse proportion to its profitability. This naturally makes it very difficult to allocate the limited resources among the many needs of the various regions.

93. The development of cotton production is a good example. The modern methods of cotton cultivation are entirely different from the traditional ones. The first ten years of effort yielded only modest results, and it was only from beginning in 1965 that, after at least three years of intensive extension work, production began to rise rapidly. In the Black Volta ORD, where extension work has been carried on longest and the density of the extension network is highest, 23 percent of the area under cotton was sprayed three times against parasites in 1968/69, and 25 percent of the

area was fertilized. In the Kaya ORD, where there are fewer extension workers and the program was really initiated only in 1966, the proportions were 3 percent and 2 percent respectively.

94. The receptivity of the farmers is also vitally important in the success of extension work. Two comparable programs undertaken to improve subsistence crops -- one in the Ouagagougou ORD, the other in the Ouahigouya ORD -- yielded very different results in the third year, as may be seen from the figures given below:

	Ouagadougou	Ouahigouya (Yatenga)
Area under grain fertilized per 10,000 farmers (ha)	14	238
Area under grain prepared per item of equipment (ha)	0.5	3.8

95. These differences are in part due to the interest which Yatenga farmers showed in every possibility of improving their food production. On the other hand, in the Ouagadougou ORD, farmers have other sources as the result of their proximity to the capital and are therefore less interested in agricultural development. Before any agricultural development program is undertaken, therefore, the authorities should make sure that the farmers are prepared to make the effort necessary to make full use of the considerable funds which must be made available to meet the costs.

Unsuitable Programs

96. Certain programs have been, or still are, unsuited to the farmers' needs. In the past the use of draft animals for tilling was considered a sine qua non of any progress in agriculture. In the Ouagadougou ORD a plan had been worked out for the large-scale introduction of donkey-drawn cultivators to improve the preparation of land for subsistence crops. This plan did not succeed because the animals were too weak to pull the selected equipment. Furthermore, the lack of any cash crop made it impossible for the farmers to pay the installments on the loans they had been granted.

97. The officers responsible for that scheme now believe that the use of draft animals for cultivation is one of the last stages in agricultural development. It can only succeed in those areas where there are oxen strong enough to pull the equipment, and where the authorities are prepared to tackle the problems of choosing and maintaining equipment, educating farmers, and training the animals.

98. The use of draft animals poses many problems for farmers. Often they have no cattle themselves, and if their families have some, these are considered collective assets whose use can be decided only by the head of an extended family group. The animals are difficult to train because they do not work regularly; and during the crop season they have to be kept in

the villages, where they may damage cropped fields. Since they can no longer graze at will, they must be fed and watered, which can often be a substantial additional chore because of the scarcity of forage. Finally, the animals have to be treated periodically for trypanosomiasis, and the equipment is expensive.

99. Draft animals often have only limited usefulness because they have to work at the end of the dry season after they have been undernourished for several months and their tractive power is at a minimum. The experience of several decades shows that the use of draft animals has been introduced, even if only on a small scale, in all those areas where it is practicable; if can of course be improved. There are several causes of the difficulties encountered in Upper Volta in introducing animal traction. Where natural and economic conditions have been favorable, the main one seems to have been inadequate training of the farmers. It is much easier to popularize the use of the cart, which is fairly easy to pull and helps to solve the major problem of transportation, than it is to introduce the plow. The popularity of animal-drawn carts in Upper Volta demonstrates this.

100. Attempts were made to popularize pest control in grain silos on a national scale; but the method proposed was unsuited to the present storage methods. The pesticide offered to farmers was "Gammagrain", which is only effective for about three months even though grain is often stored for more than a year. Any farmer wishing to ensure that his crop is properly protected must therefore make at least four applications. Thus, treatment requires a great deal of additional work as the silos must be emptied on each occasion, and the sorghum is stored in the form of panicles which are easily shattered by handling. Thus, despite a fairly good start, this scheme is unlikely to achieve all that was expected of it until a longer-lasting nontoxic product is made available or a different storage technique is adopted.

The High Cost of Investment

101. The low returns from most agricultural development activity in a country poor in natural resources seems to have led some governmental services to neglect the economic aspects of projects, no matter how fundamental, especially when the funds have been provided from abroad. The result has been that most of the programs have been very expensive. In the case of certain projects investment costs have definitely been excessive. Some examples are given below.

Erosion Control in Yatenga

102. The most notorious example of excessive costs is the soil conservation work undertaken in Ouahigouya district ("cercle"). An area of 2,540 sq kms was entirely covered with ditches and anti-erosion terraces, with dams to hold back any run-off. In 1961 the European Development Fund provided CFAF 1.34 billion to finance this project. Between 1961 and 1964 the actual

cost was CFAF 993.5 million. Today, the whole system, built without any local participation or without taking into account cropping possibilities, is not even being maintained. The only effect of this substantial investment has been to improve slightly spontaneous vegetation on uncultivated areas and to provide drinking water for livestock in the ponds above the dams during part of the dry season. Such results are derisory when compared to the size of the investment.

Investment in Dams

103. The same may be said of the dams built to provide water. Seventy dams have been built with FAC and FED funds at a unit cost of CFAF 30 million to 50 million. These dams were additional to the large number built earlier either on the instructions of the District Commandants under the old regime, or with FIDES funds, or in connection with the construction of roads across depressions ("bas-fonds"). One study has shown that in the Ouagadougou region alone there are 54 dams of various origins. The dams financed by FAC and FED were justified on the basis of local conditions. Some were intended merely to provide water for men and cattle; often a number of wells costing no more than CFAF 250,000 each would have given the same result with far less danger to health. The water in the reservoirs provides favorable breeding grounds for bilharzia and Guinea worm as well as for cattle parasites. Flies that are the vectors of onchocerciasis (river blindness) breed on the water discharged from the reservoirs; and the excessive numbers of cattle that collect near the water destroy the neighboring pastures. Other dams were intended to store water for irrigation downstream; but official statistics show that the average area capable of being irrigated by each dam is apparently no more than 47 ha. The cost of the dam alone is equivalent to an investment of CFAF 1 million per hectare of land susceptible of being irrigated. Actually, only seven out of 44 dams have been developed for irrigation. Thus it is fair to say that the return on the investment in earth dams has been very low. To the cost of the dams must be added that of the irrigation works; this too has been unduly high in comparison with norms generally applied even in countries where productivity is much greater. The cost of developing one hectare of land for irrigation in Upper Volta is never less than CFAF 500,000 and is often over CFAF 1,000,000 excluding the cost of the dam. An irrigated area covering 7.5 hectares has recently been developed downstream from an existing dam at Yaramokro in Boromo District. This project cost CFAF 270,000 per hectare, but since the internal embankments have not been built and the land has not been levelled, the cost will be more than double before the land is fit for cultivation. Strictly speaking, allowances in the costs should also be made for the salaries of the staff responsible for the planning and execution of the work. The causes of high costs in this case were the following.

> The local population was only willing to undertake a small part of the physical construction at the hourly wage rate of CFAF 50 per day plus food in the form of what is known as "human investment". The productivity of labor was very low until it was agreed to pay for earth-moving on a job rate basis.

> The works were carried out on an extravagant scale. A road more than 1 km long was built to serve a cultivable area of 7.5 ha. The adduction canal was built in reinforced concrete and its capacity, as that of the ancillary works, is too large. The filters installed were also too large, and it is doubtful whether they are even needed for the irrigation of rice land. If the volume of discharge from the dam had been accurately measured, it would probably have been possible to reduce the size of the embankment designed to protect the irrigated area against flood water discharged from the dam or even perhaps to eliminate it by straightening the tail-race.

104. The irrigation works carried out by the Chinese Corporation Mission have also been expensive. The Kou Project (Bobo-Dioulasso District) now under construction is estimated to cost $3.25 million, inclusive of a road, the adduct in canal, and the development and levelling of the land to be irrigated. In terms of local currency this amounts to CFAF 903.5 million for an irrigated area of 1,735 hectares or more than CFAF 520,000 per hectare.

105. Greater participation by farmers who are supposed to be beneficiaries of any irrigation project, and the adoption of less costly methods of development would bring the cost of irrigation down to a level at which it is at least possible to hope for a reasonable return on the investment.

Operating Costs

106. The policy of budget austerity pursued by the Government of Upper Volta has in general kept the number of public servants stationary and often deprived them of the means to work effectively. For instance, the four officers of the Agricultural Department working in the Koupela Sub-District have an operating budget, financed entirely by the local Government, which does not exceed CFAF 25,000 per year. That amount would pay for the use of a motor cycle by each of the four men for a distance of 30 km per month. Similarly, the secondary roads are falling to pieces; for lack of funds the local authorities are no longer able to maintain them.

Provision of Operating Funds

107. The operating funds needed for agricultural development can be calculated as a proportion of the estimated personnel costs in the development projects now being carried out by the ORD's.

108. The total budget of the Yatenga ORD, excluding technical assistance personnel, is CFAF 31.69 million, broken down as follows:

Salaries of Voltaic permanent staff (management, extension officers, drivers, secretaries)	CFAF 23,880,500
Purchase of additional vehicles	2,088,500
Operating costs (running costs of vehicles, temporary labor, extension costs and office supplies)	5,721,000

In addition, funds are provided for capital replacement, namely for:

Buildings, depreciated over 20 years	CFAF 1.03 million
Vehicules, depreciated over 4 years	2.90 million
Office equipment and minor agricultural equipment	0.75 million
Total	CFAF 4.7 million

The operating budget (CFAF 5,721,000) thus amounts to 24 percent, and the capital replacement budget to 20 percent of the cost of the Voltaic permanent staff.

109. The operating budget and the capital replacement budget both represent much smaller proportions of personnel costs; wherever the cost of government services is supposed to be defrayed entirely from the operating funds, they naturally seek other means of financing. They have frequently undertaken costly and unnecessary investments at the expense of less grandiose but far more profitable activities because it has been easier to obtain foreign aid for large construction projects over a short period than for developing small areas by educating, training and equipping farmers over a period of several years.

110. This trend can be seen particularly clearly in the 1960 earth dam construction program which envisaged the construction of 50 dams per year, with an annual budget that worked out as follows:-

Personnel costs	CFAF 25 million
Operating Costs	20 million
Surveys (to be contracted out or partly undertaken by the Government)	60 million
Physical works (to be contracted out)	1,000 million
Supervision of works (to be contracted out or partly undertaken by the Government)	25 million
Total	CFAF 1,130 million

111. The 1967-70 Plan provided for an investment of CFAF 4,400 million in dams and irrigation without including the operating costs of HER (Department of Rural Water Supply and Equipment) which is responsible for carrying out and supervising the projects. A 1965 report by the European Development Fund estimated that the cost of management and supervisory costs to total investment should be about 12 percent. Unfortunately, it is very unlikely that any of the projects, whether past or future, can show proper returns. The same FED report put the cost of irrigation schemes at about CFAF 1 million per hectare broken down as follows:

	CFAF
Surveys	45,000
Works	468,000
Supervision	50,000
Extension services (initial cost)	417,000
	1,000,000

The gross yield was expected to be CFAF 104,000 per hectare; rice: CFAF 42,200; cotton: CFAF 40,800; market gardening: CFAF 20,000, although this last figure has apparently rarely been reached. So far, the area actually developed for irrigation amounts to only 303 hectares out of a possible 3,700 hectares.

Cost of Extension Services

112. An attempt has been made in the tables below to estimate the cost of the extension services by relating it to the value of the products actually sold. The assumption is made that these products are the only tangible results of the program, the others being far less easily identified and probably only relevant in the long term.

113. It will be seen that in the CFDT areas, the improvement in cotton yields has significantly reduced the cost of extension per kilogram of cotton. The cost is still high--CFAF 8.8 compared to CFAF 3.0 in Cameroon -- but in the light of the production forecasts for the next few years it seems possible that the figure may drop to CRAF 5 per kilogram; at that point it could perhaps be recovered from the sales price. Looked at from this viewpoint, the CFDT program can be considered a success, although only after 15 years of effort. The SATEC program started more recently, and in a far more difficult area; its costs are distinctly higher, normally CFAF 18 per kilogram.

114. The cost of the IRHO program which, like that of CFDT concentrates on a single product, has also been declining. However, it still represents 56 percent of the price paid to farmers for each additional kilogram of groundnuts produced. Looked at another way, it works out at 38 percent of

the farm price of every kilogram marketed; and the comparable figures for cotton in the CFDT and SATEC areas are 29 percent and 59 percent respectively. The extension services are therefore still very expensive and the growers cannot yet be expected to pay for them. The net return to the farmer per kilogram of cotton marketed would fall from CFAF 24 to CFAF 15 in the CFDT areas, and to CFAF 6 in the SATEC areas if the cost of the extension services were to be deducted from the price to the producer.

Cost of Foreign Technical Assistance

115. Although necessary in the absence of trained local supervisory staff, the employment of foreign experts has several disadvantages, the most important of which are:

disparities in the technical abilities of the technical assistance officers. It is becoming more and more difficult to recruit good officers, and it is not always easy to fit them into the Voltaic government services.

the high cost of technical assistance in terms of operating costs and salaries, which would make it virtually impossible for Upper Volta to finance such assistance from its own budget if it proved necessary to do so before less costly local staff could be trained;

the sometimes doubtful advantage of accepting apparently "low cost" experts, such as young "conscripts" 1/ whose lack of experience prevents them from effectively utilizing the considerable operating funds which are often made available to them.

Agricultural Development and Agronomic Research

116. Despite their relatively modest means, the agronomic research institutions have already developed certain techniques that are of value in agricultural extension. This work should be continued.

117. Tests have shown that there are limits to the use of fertilizers on cash crops in view of the relative prices of fertilizers and grain crops. Variety trials have been undertaken for the purpose of selecting hybrid sorghum strains combining the high yields of the rather farinaceous American varieties with the hard texture and palatability of the local varieties. It should be possible to introduce these stable hybrids in a few years. Their yield should be between 20 percent and 30 percent higher than that of the

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1/ These are young "technicians" sent by the French Aid Services to perform their compulsory military service in the African countries by carrying out technical assistance tasks. Their salaries are between one quarter and one sixth of those of other technical assistance officers.

Table 14: COST AND NORMS OF EXTENSION SERVICES

	1967/68	1968/69
	(CFAF million)	
1. In Black Volta ORD 1/ (CFDT: CIDR in Hounde District)		
Value of products sold	304.8	532.2
Total outlay of ORD during crop year	153.3	151.5
	CFAF	
ORD outlay per CFAF 100 of goods sold	50	30
ORD outlay per kg of cotton sold	15.5	9.3
Weighted price of kg of cotton	31	30.5
ORD outlay per ha. under cotton	6,600	5,500
Hectares under cotton per estension officer	255	220
2. In Koudougou ORD 2/ (SATEC)		
Value of products sold	n.a.	161
Total outlay of ORD	n.a.	114
ORD outlay per CFAF 100 of goods sold	n.a.	63
Cost to ORD of extension services per kg of cotton sold 3/	n.a.	15
Net return to producer per kg of cotton (paid CFAF 30)	n.a.	23.7
ORD outlay per ha. under cotton	n.a.	6,000
Production cost per ha. under cotton	n.a.	6,320
Hectare under cotton per extension officer	n.a.	110
3. In Gaoua ORD 4/		
Value of products sold	19.3	40.2
Total outlay of ORD	21.5	29.5
ORD outlay per CFAF 100 of goods sold	111	74
Cost of extension services per kg of cotton sold 5/	52	22
ORD outlay per ha. under cotton	14,000	8,500
Production cost per CFAF 100 of products sold	17	14
Hectare under cotton per extension officer	-	85

- over -

4. In IRHO Groundnut Area 6/	1961	1967
Hectares under groundnut per extension officer	50	100
Number of farms per extension officer	78	200
Total cost of extension services (in CFAF)		
per hectare benefiting from service	14,000	6,500
per farmer benefiting from service	9,300	3,600
per kg of products sold by IRHO	12	6.3
per kg of extra output arising from work of service	14	9.6
Price per kg paid to producer	18	16.5

1/ Basic data for 1967/68, 1968/69, Volume sold: 9,271 tons and 17,128 tons; area: 22,500 ha and 27,250 ha; weighed price, depending on proportion in first grade and second grade: CFAF 31 and CFAF 30.5; ORD outlay during crop year; CFAF 153.3 million and CFAF 151.5 million; extension officers 88 and 124; production costs per ha: CFAF 6,320.

2/ Basic data. Volume sold, 1969: cotton, 5,731 tons at CFAF 30 per kg; groundnuts: 510 tons at CFAF 16.5 per kg; sesame: 15 tons at CFAF 26.7 per kg; ORD budget: CFAF 114 million; estension officers: 120; value of cotton sold, CFAF 176.7 million; area under cotton: 13,200 ha; average yield of cotton: 433 kg per ha. (Source for cotton figures: CFDT).

3/ Outlays on groundnuts and sesame have been deducted from total costs in proportion to the share of the value of these crops in total production sold.

4/ Basic data: products sold in years 1968 and 1969: cotton 327 tons and 1,069 tons with a value of 2.8 million and 32.0 million; groundnuts 320 tons and 218 tons with a value of 4.8 million and 3.3 million; paddy 270 tons and 220 tons with a value of 4.6 million and 3.7 million; area under cotton 1,200 ha and 2,800 ha

5/ To get an approximate figure, we have attributed to cotton a share of outlay in proportion to the share of cotton in the total value of products sold, namely, about CFAF 17 millions in 1967/1968 and CFAF 23.5 million in 1968/69.

6/ The figures refer to the Banfora area. The data for 1961 and 1967 are as follows: area benefiting from extension services 302 ha and 1,112 ha; increase in yield per ha. compared to traditional methods: 1,000 kg and 680 kg; producer price of groundnuts CFAF 18 and CFAF 16.5; number of farmers benefiting from extension services: 467 and 2,026; total outlay for area (FAC and national budget): CFAF 4.23 million and CFAF 7.23 million.

Sources: For 1, Reports on CFDT Operations and Ministry of Planning; for 2, SATEC Reports and Accounts; for 3, CIDR Reports and Department of Rural Development, Report on Operations in Diebougou Gaoua; for 4, IRHO annual reports.

present varieties. There are some farinaceous sorghums originating in Uganda that would give yields between 50 percent and 100 percent greater than those of the traditional varieties. Extensive trials of these varieties have not been carried out because farmers are said to consider them unpalatable. However, the rural population has eaten American varieties imported directly from the United States in times of famine, and the consumption as food of red sorghums, normally grown for beer, is increasing. It would therefore have been desirable to try to popularize the use of the farinaceous varieties, allowing farmers to choose between the low-yielding but palatable traditional varieties, which entail the risk of shortages in the period immediately preceding the harvest, and the higher-yielding but less palatable varieties, which are capable of providing an assured food supply throughout the year. The stakes are high enough for the choice to have been put squarely before the farmers. Their response might have made it possible to avoid carrying out a long and expensive program of selection.

118. With respect to cash crops, efforts to improve varieties should be continued, starting, as in the past, from imported strains. The rate of fertilizer application and the best cultural techniques are already known, although more information is needed on certain points such as the crop rotations and the types of fertilizers that are most suitable. Further efforts will, however, be required to stop the spread of a fungus growth on cotton that causes the abnormal transformation of the floral structure into leaves.

119. Seed multiplication for commercial crops has been well organized. For subsistence and fodder crops it should be improved in cooperation with the ORDs and the extension service. To leave actual seed production to a research institute, which should only have to provide technical supervision, is to waste the time of a skilled staff that is already fully occupied by other more demanding tasks. It seems likely, however, that in some areas expansion of fodder crops will be restricted by ecological conditions.

C. Current Projects

Execution of the Plan

120. The 1967-70 Plan provided for an expenditure on rural development of CFAF 7.8 billion, or 28.3 percent of the total outlay. It was also assumed in the Plan that total production in the rural sector would increase at an average rate of 3.3 percent per year and would reach a figure of CFAF 52.5 billion in 1970.

121. The forecasts for the exports of the main agricultural products at the end of the Plan period are summarized in Table 15.

Table 15: PLAN PROJECTIONS OF AGRICULTURAL AND LIVESTOCK EXPORTS AND ACTUAL 1969 EXPORTS
(In millions of CFA francs; quantity in thousands of tons)

	1970 Projections			Actual Quantity in 1969
	Value	Percent of Total	Quantity	
Livestock	3,800			a/
Meat (carcass)	300	56	-	1.7
Leather & skins	100			
Ginned cotton	1,500		15	8.7
Cotton seed	200	22.6	10	10
Hulled groundnuts	800	10.6	20	8
Fruit and vegetables	190	2.5	-	-
Sheanuts	150		10	
Shea butter	40	2.5	5	10.6
Oilcakes, misc.	50	0.7	-	-

a/ Exports of livestock, 1969: Cattle 12,000
sheep 6,250
goats 1,350

122. Implementation of the Plan has lagged, particularly in the rural sector. Total development expenditures on the rural sector in the years 1967 to 1969 inclusive were CFAF 3,167 million or 53.4 percent of the target for this period. This amount was spent principally to finance the activities of the ORDs. Nevertheless, certain specific projects have been worked up during the Plan period; one of these, looking toward the further development of cotton production in two ORD's, has been prepared for IDA financing; others are in various stages of preparation or consideration.

Cotton Development Project - Bobo-Dioulasso/Black Volta

123. A project for the development of the Black Volta and Bobo-Dioulasso ORDs, focusing principally on cotton production was prepared for IDA financing. The project, as submitted, covered a total area of 58,000 sq.km, comprising 55,000 farms and 800,000 inhabitants. In 1968/69 this area produced about 19,000 tons of seed cotton, representing a substantial increase over

the 4,200 tons of 1965/66, thanks to a continuing extension effort. The technical ability of the farmers has noticeably increased during the past few years, and the average yield has risen from 360-380 kg per ha to about 550 kg per hectare, owing to the introduction of improved methods. The purpose of the project was to raise the output of cotton to 75,800 tons in six years, with an average yield of 840 kg per hectare by continuing to educate the farmers in the use of the methods currently advocated, namely, the use of insecticide sprays, fertilizers, and animal-drawn equipment. Project targets are set forth in Table 16. It is expected that the yield of subsistence crops will also increase as the result of seed treatment and the residual effects of fertilizer applied to cotton on food crops. 1/

Table 16: TARGETS FOR COTTON CULTIVATION IN THE BLACK VOLTA AND BOBO-DIOULASSO ORDS

	1968	1975
Total area - ha.	34,400	88,200
Yield per hectare - kg.	550	840
Output - tons	19,000	75,800
Area treated with insecticide alone - ha.	7,000	32,600
Area treated with both insecticide and fertilizer - ha.	7,500	25,700
Area treated with insecticide and fertilizer, and tilled with animal-drawn equipment - ha.	-	7,200
Area under traditional cultivation methods - ha.	19,900	23,700

124. The personnel required for this project was estimated at seven senior staff (to be provided by CFDT), 12 sector chiefs, 53 sub-sector chiefs, 287 farm-level extension workers and 34 administrative staff. The construction of nine dwellings, two offices, 32 storage sheds, four central silos and two ginning mills with a combined capacity of 50,000 tons was envisaged. Provision was also made for the improvement of some of the tracks used for collecting the crop. The total capital outlay was put at approximately CFAF 931 million, of which 16 percent was for buildings and equipment, 52 percent for the ginning mills and 32 percent for the tracks. Annual operating costs (personnel, offices, vehicles, and contributions to agricultural research) were expected to rise from CFAF 52.1 million the first year to CFAF 344.3 million in the sixth year. Farmers were to increase their outlays on fertilizer, insecticides, and equipment from CFAF 248.3 million in the first year to CFAF 469.1 million in the sixth year.

1/ The figures in paragraphs 123-125 relate to the project as originally submitted to the IBRD. Details on the project as revised by the Bank appraisal mission are given in Bank Report No. PA-58 "West Volta Cotton Project: Upper Volta", September 8, 1970.

125. The value added by the project at the farm level was expected to rise from CFAF 3.8 million in 1970 to CFAF 4.7 million in 1975. It was anticipated that the net income of the best farms would rise from CFAF 15,000 to CFAF 95,000 per year. The project was expected to yield a return of 46 percent on the basis of prices prevailing at the time the project was formulated, and of 28 percent on the basis of an assumed drop in price.

Table 17: ESTIMATE OF COTTON PRODUCTION IN UPPER VOLTA, 1969-1985
(in thousands of tons of seed cotton)

	1969	1975	1980	1985
Target for Upper Volta, 1980			120	
Production in project area	19.3	75.8	95	119
Production in remainder of country	12.7	-	25	-

In the period 1969-1980 production in the project area was to rise at an annual rate of 15 percent as compared with 6.5 percent for the rest of the country.

Sugar Development Project - Banfora

126. The object of the Banfora Project is to create an agro-industrial complex including a sugar factory with a capacity of 15,000 tons per year, with possible extensions to 20,000, 25,000 and even 30,000 tons, depending on the size of the market in Upper Volta, which is expected to amount to about 15,000 tons in 1973. The project has been made possible by studies and experiments carried out since 1965 by the Societe d'Etudes du Sucre en Haute-Volta (SESUHV) under a budget of CFAF 105 million. 1/ Part of the factory's output is to meet local demand, and the remainder -- at any rate in the earlier years -- is to be exported to the northern part of the Ivory Coast.

127. The project will involve major outlays in three sectors, namely:

(1) provision of water from the Yanon and Comoe rivers to the plantation and factory (estimated cost: CFAF 600 million);

(2) the planting of sugar cane on 1,500 ha. (to be increased later to 3,000 ha), the installation of a system for overhead irrigation, and the acquisition of agricultural and transport equipment (estimated cost: CFAF 700 million);

(3) overhead expenses and the factory itself, with a daily capacity of 120-130 tons of sugar (about CFAF 1,700 million).

1/ See Annex 1, Table XII: Banfora Sugar Project.

The total outlay for the program will thus amount to about CFAF 3 billion.

128. The agreement signed in October 1968 provides that the project will be managed by SOSUHV, in which the Government of Upper Volta would hold 33 percent of the shares and the Societe des Grands Moulins (of Paris) most of the remainder. The share of the Government of Upper Volta is to be contributed in the form of land (10,000 ha. valued at approximately CFAF 13,000 per hectare), and of an investment to supply water to the border of the plantation. It is envisaged, provisionally, that:

(a) financing of water supply will be arranged by the Government,

(b) the necessary expropriation of land will also be at the expense of the Government 1/, and

(c) that the necessary other investments (CFAF 2,400 million) will be provided by equity capital (CFAF 700 million or 30 percent) and by loans (CFAF 1,680 million or 70 percent), of which two-thirds would be repayable in 20-25 years and the remainder in 10 years.

129. Some 1,500 ha. are to be planted in 1971 and a similar area in 1972. On the basis of recent trials the yield is expected to be eight tons of sugar per hectare; it may even go as high as nine or ten tons per hectare, which would be excellent. The necessary propagation was initiated in November 1969, so that the first 1,500 hectares could be planted by September 1971. The cane would be cut six times before being replated. With irrigation, the annual yield is expected to be 70 tons of cane per hectare, with a sugar content of 12 percent. Using the varieties best adapted to local conditions, the yield might rise to between 90 and 100 tons of cane per hectare. It is intended to apply fertilizer at the rate of 140 kg. of nitrogen, 140 kg. of phosphoric acid and 40 kg. of potash per hectare per year. The plantation will give employment to 1,000 workers when in full production. No estimate has yet been made of the number of jobs that might be created by the factory. As a first step, a plant to produce 15,000 tons of cube sugar from imported sugar was brought into operation in October 1969 at a total cost of CFAF 300 million. The sugar is imported from Congo (Brazzaville).

1/ No funds have been allocated for resettling the dispossed farmers.

Table 18: ESTIMATED PRODUCTION AND CONSUMPTION OF SUGAR

	1968	1969	1970	1971	1972	1973
Production ('000 tons)				7	12	15
Consumption ('000 tons)	10.5	11.2	12.3	13.2	14.1	15
Investment in Sugar (CFAF millions)	180	425	448	1,897	50	-

Source: OCAM Sugar Council.

130. The sugar project could be justified on the basis of the present rather high cost of importing sugar. Under the OCAM agreements, sugar importing countries are obliged to obtain 70 percent of their supplies from OCAM countries at a price well above the world market price (i.e. CFAF 50,000 per ton c.i.f. Abidjan, compared with CFAF 34,650 per ton on the world market in 1969). In addition, importing countries have undertaken to collect duties amounting to CFAF 4,500 per ton of sugar purchased at the world market rate to finance the OCAM Equalization Fund. The OCAM agreement thus raises the cost of Upper Volta's sugar imports by about CFAF 140 million per year for the benefit of the sugar producing countries 1/. Within each country there is an equalization fund to assure a single retail price for sugar regardless of the country of origin.

131. While the project appears to have some merit on these grounds, the proposed allocation of costs is open to question. For instance, no arrangement is contemplated to charge the plantation or mill for the water to be supplied by the Government, and the latter may well have difficulty in obtaining financing of water supply on this basis.

132. Moreover, the social problem involved in displacing farmers in the project area will have to be resolved. While the number of farmers involved is not large, they are already pressing claims for compensation for a type of wild palm (Borassus) which grows on this land even though it is not particularly valuable. The dimension of this problem is larger than appears because some 10,000 ha are said to be needed to provide 3,000 ha cane planting. 2/ The expropriation of that much land in a country where

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1/ This is made up as follows on the basis of imports of 11,000 tons in 1969/70: difference between OCAM price and world price: CFAF 15,350 x 7,700 tons = CFAF 125.9 million; duties at CFAF 4,500 on 3,300 tons = CFAF 14.8 million.

2/ Land with the best soils was selected for the project and since that consisted of widely scattered plots, it was thought necessary to include all of them in a larger area in order to facilitate the construction of a plantation road network and to keep out trespassers.

good land is scarce may be justified only if the land not put into cane is used for other productive purposes such as an intensive cattle raising and fattening scheme run in conjunction with the sugar plantation.

133. In brief, the justification for the project depends on the benefits likely to accrue to the Voltaic economy. To determine these benefits it is essential to know:

(1) the probable cost of production, taking into account all costs, including those for the supply of irrigation water. Owing to the lack of even provisional estimates of operating costs, there is as yet no way of determining the cost of imported sugar;

(2) the net income that might accrue to the Government, as compared with the revenues now derived directly and indirectly from the import of sugar;

(3) the economic feasibility of a cattle fattening or feed-lot operation that might make use of the by-products of sugar production, and might help to improve the rate of return on the project as a whole.

134. It therefore seems unwise at this stage of the preliminary studies to make a final judgment on the merits of this project. Detailed and convincing data will have to be built up. A detailed technical, financial and economic study must be made before the Government can submit the project for outside financing and determine whether it is of sufficient interest to the economy.

The Vegetable Oil Mill Project at Bobo-Dioulasso

135. The purpose of the project is to establish a new vegetable oil mill in Bobo-Dioulasso with a throughput of at least 20,000 tons of oilseeds per year. The oil mill would be owned by the Societe des Huiles et Savons de Haute - Volta (CITEC). The contractual agreement was signed in June 1969. The plant is to be capable of handling 15,000 tons of cottonseed, 2,200 tons of sheanut kernels and 2,800 tons of shelled groundnuts per year. Capacity would be increased to 40,000 tons if the expansion of the cotton crop made this desirable. This output would consist of:

750 tons of cottonseed oil for soapmaking;

240 tons of groundnut and cottonseed oil for the local market;

1,033 tons of semi-refined oil for export;

5,326 tons of cottonseed cake (Ex factory price: CFAF 10,000 per ton);

748 tons of groundnut cake (Ex factory price: CFAF 12,500 per ton).

136. The plant is expected to cost CFAF 750 million, of which two-thirds will be for equipment. It is to be financed in equal proportions by (1) rather short-term credits to be provided by the Bouassac group (owners of CITEC), (2) medium-term suppliers' credits, and (3) a long-term loan to be found abroad by the Upper Volta Government. Both FAC and FED refused to provide financing because of the excessive cost of the project. The economic justification of the project is not yet clearly established. It will depend on whether or not it is more advantageous to export oil rather than oilseeds, taking into account the processing costs and the prices at which oilcake can be marketed, both locally and abroad.

Other Projects

137. Flour Mill. The Grands Moulins de Paris Group is establishing a flour mill with a daily capacity for milling 1,200 quintals of imported wheat mixed with 400 quintals of millet and sorghum. The by-products would be converted into cattlefeed, which would be exported or perhaps consumed in part on a cattle-fattening scheme that has been proposed by the Banfora region. The capital outlay will be about CFAF 500 million, and will be financed entirely by private investment. It is hoped to have the mill in operation by the end of 1970.

138. Market Gardening. A project for expanding market gardening activities is now under review by FAC. The purpose is to develop some 150 hectares for market gardening, 50 hectares below the Loumbila dam 1/, the construction of which is to be financed by FED, and 100 ha. in the Plain of Banankeledaga 2/. Market gardeners who are members of the cooperatives at Ouagadougou and Bobo-Dioulasso would be settled in the areas under consideration. Most of the output would be exported to Ivory Coast. There is a danger, however, that the market will soon be saturated as Ivory Coast production is also increasing. New markets, probably in Europe, would be needed to absorb the additional output to be produced by the project. While projects on this scale seem out of line with the possible outlets either in Upper Volta or abroad, the execution of smaller ones within the ORDs would serve to meet an ever-increasing demand, especially in the larger towns and the District Centers (chefs-lieux de cercles).

1/ 20 km north of Ouagadougou.

2/ 17 km north of Bobo-Dioulasso.

Table 19: MARKET GARDENING PROJECT

	Additional Output available for export (tons)	Projected Imports by Ivory Coast (1975) a/ (tons)
Beans	108	100
Melons	96	-
Strawberries	48	-
Tomatoes	240	-
Carrots and turnips	405	580
Cabbage and cauliflower	256	620
Leek	200	120
Lettuce	200	350

a/ SEDES survey figures.

Source: Ministry of Agriculture

III. POSSIBILITIES FOR AGRICULTURAL DEVELOPMENT

A. Economic Prospects

Evaluation of the Economic Potential

139. The evaluation of the potential for agricultural development is hampered by serious gaps in the quantity and quality of data and by inadequate preparation of development programs and projects. The present situation is not well known, and too few studies have been made -- especially on soils, agricultural production, animal husbandry and their relationships to farming, the rural population, and population movements. Furthermore, those studies that have been made remain largely unused (as in the case of agricultural research). Better evaluation of the potential is therefore a prerequisite for any long-term development program. We must limit ourselves for the present to indicating roughly what opportunities and plans of action may exist.

140. No program calling for sizable investment, however, should be undertaken without a minimum of information on the basis of which the major problems can be identified, broad lines of action laid down, and results checked. An agricultural survey should be undertaken to provide essential data on:

(a) The number of farms

(b) The total population and the active population

(c) The area under cultivation, broken down by crop

(d) The yield per hectare of the principal crops

This information can be obtained from local sample surveys, all of which should be made the same year, if possible, to provide a uniform statistical base, but which can be spaced over several years if necessary. The results should then be brought up to date regularly by annual spot checks.

141. It would be much easier to evaluate the economic potential if a documentation center were set up. Many interesting studies have in fact been made in Upper Volta. The reports describing them are often out of print or scattered among the various departments concerned. There is a risk of losing track of data and wasting time by repeating long and costly studies. A team of experts should be given the task of cataloguing all these reports and analyzing them briefly. The reproduction of all or part of the documents of general interest would enable copies to be made available on request to anyone needing them.

Demand and Production Goals

Domestic Demand

142. The medium- and long-term development of internal demand for essential foodstuffs provides a basis for setting production goals. Domestic demand for basic food products should as a minimum be expected to increase in line with population growth, i.e. at an annual rate of 2.1 percent. We would thus expect sorghum and millet production to increase from 830,000 tons in 1970 to about 1.04 million tons in 1980. A per capita increase in sorghum and millet consumption does not seem probable. Maize production, on the other hand, should increase more rapidly, at a rate of at least 4 percent annually, to cover growing demand. Present trends indicate that overall demand for basic cereals will remain relatively stable but that there will be some shifts in consumption due to the increase in money income from wage and salaries, cotton and livestock. In the cities, demand for rice, meat, fruit and vegetables will tend to increase, and in the rural areas there may well be increasing consumption of rice, a prestige food, and certain vegetables. The effects on income of the cotton development program and of better livestock marketing would only strengthen these trends. By 1980, for example, additional cotton sales alone might increase the average money income per farm by 17 percent. 1/ Under these conditions, demand for rice might well rise so rapidly that even if production were doubled 2/ the need for imports would not be eliminated. Consumption of animal proteins is also likely to rise. Internal demand for fruit and vegetables around 1980 cannot be quantified, but there will certainly be a larger urban and rural market.

143. No increase in groundnut exports is expected, especially since the development of cotton production in the Bobo-Dioulasso ORD will probably be in part at the expense of groundnuts which is a less profitable crop for the peasant. Taking into account principally an expected increase of 2 percent per year in internal consumption, production in 1980 may be projected at about 90,000 tons. Sugar consumption, which is estimated at 12,000 tons in 1970, will double to reach 24,000 tons in 1980 according to OCAM projections.

1/ Calculated on the assumptions that (1) the rural population in 1980 will be 5.5 million, (2) per capita money income, other than that derived from additional cotton production, will remain unchanged at CFAF 1,900, or a total of CFAF 10.4 billion, and (3) an increase of 90,000 tons on cotton production at CFAF 25 per kg (CFAF 20 net) will yield an increase in money income of CFAF 1.8 billion.

2/ This goal could be achieved by (a) increasing the yield of the 40,000 hectares now in rice and (b) adding 10,000 hectares of irrigated bottom land to the present total over a ten-year period.

The External Market

144. CFDT has set a production goal of 120,000 tons for 1980. This should not be exceeded, partly because the market is rather uncertain and partly because other Western African countries are competing in expanding production, which may bring prices down in the long run. It would be desirable to allocate the increase in cotton output in such a way as to permit the largest possible number of regions to participate in the resulting benefits. Of present production, 86 percent now comes from two ORDs, Kaya and the Black Volta.

145. Prospective oilseed markets are limited. Little progress can be expected in the case of groundnuts, since prices are unlikely to be sufficiently remunerative to increase production for export. Sesame sales can also be expected to remain at the present level. The supply of cottonseed will rise rapidly if Upper Volta carries out its ambitious cotton program. The export of this increased production will be of interest if prices cover at least the costs of marketing and transport. The management of CITEC believe that Upper Volta could sell 40,000 tons of sheanuts (karite) on the world market. This amount, though not very large, is unlikely to be attained without a strenuous effort to improve the collection and grading of the nuts.

146. In any case, sales of livestock and meat to the countries along the coast will continue to account for a major part of Upper Volta's exports. The country must in fact earn a substantial income from livestock raised on its territory and from cattle in transit from Mali and Niger.

Processing of Agricultural Products

147. Agricultural development policy must include an effort to process products in response to demand. Here much has already been done or is in process in the following fields:

(a) the processing of cotton for the domestic market by the Voltex spinning and weaving mill;

(b) the processing of oilseeds. The existing CITEC plant is now satisfying domestic demand, and the planned addition should work partly for export;

(c) the production of flour (the project of Grands Moulins de Paris) provides for the milling of millet and sorghum as well as wheat;

(d) sugar: the SOSUHV project in Banfora;

(e) rice milling: efforts must be made to improve husking in rural areas.

Projections

148. The very rough estimates of trends in demand can be translated into possible production goals for 1980. 1/ These goals imply not only an improvement in yield but also a further expansion of the area under cultivation. The increase in yields that might be achieved by 1975 and 1980 will be a function of the success of extension programs in promoting the adoption of better methods of production. It is unlikely that average 1980 yields will be better than can be achieved by using good seed and fertilizer, and, for cotton, by spraying. The maximum yield in 1975 can be estimated as equal to the arithmetic mean of the 1970 and 1980 estimates. The improvement in yields possible on this basis is set forth in Table 20.

Table 20: PROJECTION OF POSSIBLE YIELDS

(kg per hectare)

Crop	National average yield, 1970	Improved yield 1975	Improved yield 1980
Sorghum	550	715	875
Millet	500	650	800
Seed cotton	425	585	750
Rice	900	1,200	1,500
Maize	600	775	950
Groundnuts in the shell	700	830	950

149. Table 21 below projects the area that will have to be cropped in 1980 in the alternative assumption of no increase in yield and of the rise in yields postulated in Table 20. It is evident from this table that if the yield is not improved the area under cultivation will have to be increased nearly 40 percent, whereas if the yield is improved the area can remain roughly as it is in 1970. The first alternative would involve a long-term risk of depleting the soil capital of Upper Volta. It would be possible to put 700,000 hectares under cultivation within the next ten years only by considerably reducing the area of fallow land in the most heavily populated zones. On the other hand, the second alternative can hardly be considered a realistic possibility within the next ten years. It is more reasonable to expect some improvement in yields combined with an expansion of the area under cultivation by 300,000 hectares to about 2.2 million hectares. This increase in the cultivated area, if it is not to be at the expense of fallow land in highly populated areas, must take place in the sparsely populated areas (Fada N'Gourma, the East, the Southwest) and uninhabited regions (the White Volta and the Red Volta River Valley).

1/ See Annex 1, Table XIII.

A plan for settling the uninhabited regions, predicated on the needs of Upper Volta in 1980, should have the goal of adding about 150,000-200,000 hectares to the cropped area. Allowing for fallow, this is the equivalent of 600,000-800,000 hectares. On the basis of 0.40 ha. of cultivated land per person, this would provide a livelihood for about 400,000-500,000 members of the rural population.

Table 21: ESTIMATE OF AREA UNDER CULTIVATION, 1980 /a

(thousands of hectares)

Crop	1970 Cultivated area	1980 Cultivated area (no improvement in yield)	1980 Cultivated area (with increased yield postulated in Table 20)
Sorghum)		1,000	800
)	1,400		
Millet)		680	425
Maize	150	260	170
Fonio	40	50	50
Cotton	80	260	160
Rice	40	80	55
Groundnuts	100	100	90
Sesame	30	30	30
Total	1,850	2,460	1,780

/a Figures are approximate and rounded.

B. Long-term Need for Integration of Agriculture and Animal Husbandry

Farming and Livestock Policy

150. The integration of agriculture with animal husbandry stands out as one of the major themes of overall agricultural development. Its importance is evident in terms of the need to raise livestock productivity in line with the rising demand for meat, and to bring about a better distribution of land in the light of requirements for grazing, cultivation and fallow at a time when the expansion of the cultivated area is coming

into increasing competition with the system of "extensive" livestock management. Without such integration, animal husbandry, which now provides the country's major export, will decline drastically in moderately and densely populated areas, and Upper Volta may become a net importer of meat within less than 20 years. The integration of agriculture and livestock-raising is further justified insofar as it will in the long run bring about a socio-economic transformation of farming patterns by providing draft animals and organic manure and enabling farmers to diversify by growing fodder crops. Furthermore, it would permit a more rational and fuller use of manpower over the year and raise farm income through the introduction of complementary animal husbandry and meat production.

151. There is at present no overall policy of integrating agriculture and livestock-raising in Upper Volta. A limited effort has been made to introduce animal-drawn implements as a means of increasing crop production. The use of donkeys to draw cultivators has proved a total failure, while draft oxen have increased slightly in numbers (but only very slowly) in the most favorable areas. Table 22 shows how the number of draft animals has increased.

Table 22: DRAFT ANIMALS IN UPPER VOLTA

	Oxen	Donkeys	Horses
1965	4,000	8,000	50
1969	6,500	8,100	50

This campaign to introduce animal traction has not yet succeeded in bringing about a profound change in the attitudes and operation of farms, except for a select few. Although the success obtained after long years of effort in some countries (Mali, Senegal, Chad, and Cameroon) may make it worthwhile to persevere in this campaign, it must be emphasized that many problems remain unsolved and that the scale of the effort must be broadened if any real integration of agriculture and livestock-raising is to be achieved. Stress must be laid on making livestock-raising an integral element of farming, on improving fodder crops, on introducing animal-drawn implements, on better animal husbandry (feeding and animal health), and on extension services.

Reorganization of Agriculture and the Introduction of Animal Husbandry

152. Outside of the Sahel and adjoining areas, where the owners of livestock are also the breeders, animal husbandry in Upper Volta is dominated by the almost complete separation of farmers and livestock-raisers. The former hold the rights to grazing land (consisting mainly of fallow land in densely populated regions) and own some of the livestock. The

latter, who are nearly all Fulanis, look after the farmers' herds and thus obtain the right - generally de facto - to use grazing land for their own livestock. Peasants who raise their own stock are rare except perhaps among some groups of the tribe. Table 23 shows the distribution of cattle.

Table 23: DISTRIBUTION OF CATTLE BY AREA IN 1970

Location	No. of Head (thousand)
Traditional herders and other breeders in in the North	600-700
Central belt, largely unsuited for cattle-raising (where conventionally half of the stock are owned by farmers and half by breeders)	800
Southwest and Southeast, well suited for the integration of farming and animal husbandry	1,000
Approximate total	2,500

153. Farming and livestock raising, while closely dependent on each other, are coming into increasing conflict as and when population pressure increases beyond the point already reached on the Mossi plateau. To this problem must be added that of "stray livestock" (particularly livestock in transit), which are grazed on pasture land without legal authorization, thus aggravating the conflict. This structural situation should be altered by integrating agriculture and livestock-raising. Such integration requires that:

1) Herds pastured on farmland (cultivated area and fallow land) be controlled by local farmers. This first condition alone would rationalize the use of land and pasturage. Direct control of herds by farmers would also allow traditional village organizations to take part in regulating the movement of the herds. But in overpopulated areas this would lead to the reduction--and sometimes even to the disappearance--of stock not owned by the farmers, or to farmer ownership of such stock to the extent that population would permit;

2) Once the first condition is fulfilled, the problem of integrating farming and livestock raising be attacked as a whole, and not, as has hitherto been the case, through such limited programs as the encouragement of farming with draft animals.

154. To tackle the "agriculture-livestock" problem it is necessary to devise "farm-livestock" plans, on a village or inter-village scale, which would provide for:

(a) a land-use plan, with (1) unenclosed areas under crops with natural fallow; (2) areas under intensive cultivation that could be closed off, and (3) areas of common pasture land;

(b) a system for planned rotation of crops and fallow through regrouping village land by blocks in order to facilitate the protection of crops grown on such consolidated areas as well as the grazing of fallow land;

(c) determination of the optimum livestock carrying capacity of common pasture land;

(d) a schedule for rotating the use of pasture land;

(e) a program for improving pastures through the introduction of fodder crops;

(f) a system of controls and sanctions administered by the traditional village institutions;

(g) proper supervision and herding of livestock.

155. Such a program would certainly encounter considerable difficulties. The community organization required by systems of village management might not be favorably received by farmers, who are now trying to shake off traditional collective restraints and becoming increasingly individualistic. The economic advantages of village organization, however, might offset this tendency.

Better Feeding of Stock: Development of Fodder Production

156. The introduction of fodder crops poses a large number of difficult technical problems. Research in Saria and Farakoba indicates that where the mean annual rainfall is 700-1,000 mm the hardiest fodder crop is Crotalaria juncea (12-15 tons of grass per hectare per year) and that when the soil is more fertile, Pennisetum pedicellatum can be used (20-25 tons per hectare per year). In more humid regions (the Southwest), Stylosanthes gracilis and Bracharia ruziziensis yield more grass (30-35 tons) if the soil is rich enough. None of these plants stands up well to grazing, and, except for stylosanthes, all are easy prey to weed growth. They are thus suitable only for temporary grazing and must be cut. The conservation of fodder is difficult. Ensilage entails rather sophisticated techniques. It cannot be practiced by a single farmer, since losses are considerable for small pits, and the use of a collective silo is very complicated.

Rough fodder is ill suited to the production of high-quality hay. Fodder-crop production is very demanding of labor in the preparation of the land, sowing, cutting, transportation, and storage, and production is low and often of mediocre nutritive value.

157. No plant introduced from outside has proved better than or even comparable to the local grass (andropogon) for providing permanent grazing in dry areas, so that nothing can be done at present to improve fodder-crop production on fallow land in areas where the average annual rainfall is 700-1,000 mm. Where it is wetter, stylosanthes will grow, but its yield cannot yet be determined with any accuracy. If high-yield varieties of sorghum were widely cultivated, some of the excess production might be fed to livestock. In Yatenga, where fodder is particularly short, the peasants do give a little grain to their draft cattle. But even if sorghum production were greatly increased throughout Upper Volta, the need for human food is such that the surplus available for livestock will be small and can be used only to supplement a feeding program that will have to consist essentially of fodder or of industrial by-products (milling by-products, peanut cake, cottonseed, and molasses).

158. Research in fodder production must therefore be continued on a larger scale than before if farmers are ultimately to have the means of keeping livestock both for traction and meat production. The selection of fodder crops must be adapted to ecological conditions in the various regions, especially the dry ones; and the methods of cultivating them must be perfected in such a way as to make it compatible with available labor and equipment. The optimum role of fodder-crop production in farming must be determined in the light of economic considerations.

159. The cultivation of fodder crops could be propagated by the extension service if seed of the most useful species (stylosanthes and bracharia) were available. The multiplication of seed has been entrusted to IRAT, which cannot handle it without detriment to its own research activity and in addition has neither the equipment (combines and grazers) nor the staff necessary for this work. It might be assigned to an ORD provided with the necessary means.

Limitations of Draft Animals and Equipment

160. Interesting experiments with animal-drawn implements have been made. Although these were supposed to have guided SOVICA 1/ in the manufacturing of implements for the Voltaic market, this company has not always adhered to the necessary technical standards. The cultivators manufactured in Upper Volta are often sharply criticized for failing to stand up to the strains normally put upon them. The quality of equipment manufactured in Upper Volta must therefore be improved.

1/ SOVICA: Societe voltaique de montage de materiel agricole (Upper Volta Farm Equipment Manufacturing Company).

161. One major problem probably cannot be solved by the animal-drawn implements currently in use. Although with such tools a larger area can be tilled than by hand, they do not make it possible to sow any earlier in the year, and early sowing is most important to good yields. In fact, owing to insufficient draft power, animal-drawn implements can only be used to work fairly soft soil, which means that farmers must wait until the first rains (a good part of which then runs off or evaporates) have made the soil sufficiently moist. The tractive power of animals could be considerably improved by:

(a) better training of animals, involving their more regular use throughout the year;

(b) better harnessing;

(c) more regular feeding.

(d) putting the animals to work when they reach adulthood, i.e. after 3 1/2-4 years.

These improvements would enable animals to do heavier work and in particular facilitate earlier and more rapid land preparation.

162. Land preparation by tractor-drawn implements would seem to be the best solution for the early-sowing problem, but it cannot yet be brought into general use in Upper Volta. The present tractors cost too much and are overpowered for the scale on which they would be used there. They would require a radical modification of land tenure and farming systems, the regrouping of cropped land, adherence to a strict working schedule, and a uniform rotation of crops by all farmers. These changes cannot be made easily. It would thus be desirable to perfect a low-cost, lower-powered motor implement which could be used for land preparation without a complete revision of farming methods.

163. The carts used in Upper Volta are well suited to their task. Their high cost does not seem to prevent them from being widely used.

Animal Husbandry

164. The integration of agriculture and livestock-raising involves the carrying out of an animal husbandry program far broader in scope than that of the existing livestock service. The latter has had funds, albeit limited, only for animal health, and has had neither the technical staff nor the research facilities that it would need to deal with the complex problems of integrating agriculture and livestock-raising and to use the knowledge thus gained to formulate an adequate policy. The problems of animal husbandry are numerous and still largely unexploited.

Definition of Goals

165. The food situation in Western Africa unquestionably calls for first priority to be given to meat production. The provision of animal traction is a relatively secondary goal, and seems to be one way of keeping a small part of the livestock on the farm by employing it in farm work.

Herd Management

166. We have already emphasized the fact that agriculture and animal husbandry, although they subsist on the same area of land (now under crop, now lying fallow), have hitherto been completely separated. Their integration requires the establishment of new systems of land use. These might envisage:

(a) The keeping of three head of cattle directly on the farm under a system of intensive management; all of these would be draft-oxen, but one of them, after having served as a draft animal for a few years, would be fattened for the market; at a later stage a female might be added for breeding.

(b) The maintenance of small herds under semi-extensive grazing, supplemented by fodder production. This entails the enclosure of cultivated areas, collective herding by farmers, the selection of fodder crops adapted to the region as well as their conservation.

(c) The keeping of larger herds on the basis of extensive grazing, involving some rationalization of the existing system of livestock raising which in essence cannot be altogether abandoned for a long time. It involves in the main the formation of village herds and collective grazing, more rational use of grazing on national pastures and fallow land, with rotational grazing, and possibly a supplementary feeding program. It also entails village control of the use of land for pasture or traditional range lands near the fields and fallow lands kept for agricultural purposes.

Choice and Improvement of Breeds

167. The choice between Zebu cattle and "taurins" (smaller, trypanosomiasis-resistant breeds) must be made on the basis of ecological conditions. Research to improve breeds, particularly aiming at the "taurins", must be pursued as a long-term objective. Both "taurins" and Zebu cattle can be used as draft animals, depending on local conditions; the use of donkeys has proved a failure.

Conditions of Husbandry

168. The proper care of animals on the farm is of primary importance. The requirements in this respect are the following:

(1) In addition to a maintenance ration, the animal must receive supplementary feed if it is to be employed for traction or to be fattened. It cannot simply be left to forage for its own food after it has been employed for work in the field, pulling implements or a cart.

(2) Constant watch must be kept over the animal's physical condition in order to detect signs of parasitic infestation, contagious

disease, or trypanosomiasis (sleeping sickness), where these are endemic. Health protection thus includes regular examinations and the appropriate prophylactic measures, the cost of which is not negligible and must be taken into account either at the producer's level or at the ORD level as part of a collective campaign.

(3) The prosecution and intensification of an animal-health program is of course also necessary for the livestock which is kept under extensive or semi-extensive management on the basis of more rational utilization of cultivated and fallow land owned by the villages.

Improvement of Performance

169. The production of meat initially from draft animals depends primarily on the manner in which the animal has been used. It should obviously not be trained as a draft animal too young, for otherwise its growth will be arrested and it will be subject to rickets. Experiments in Saria indicate that three years is the minimum age for training, and four years for regular work. To take full advantage of the possibility of later fattening it for meat, the animal should not be used more than four consecutive seasons. This would improve capital turnover and facilitate the take-off of progeny of existing breeding stock.

170. It will be recalled, however, that the available knowledge of methods of improving performance is very inadequate. Much research is still necessary to improve conformation and meat yield, develop the most economical rations, and to determine the best means of eventually introducing female breeding stock as an integral part of the operation.

Recommendations on Extension Services

171. Assuming that adequate technical measures make it possible to eliminate the shortcomings in animal husbandry and farming practices which now hamper the integration of livestock and agriculture, the extension services will still have to persuade the farmers of the advantages they can gain from integration and acquaint them with the methods they must use to obtain the desired results. This should be done by the regular extension staff supported by specialists. For this purpose the staff working in areas suitable for the integration of agriculture and animal husbandry should be given appropriate supplementary training which should not be confined simply to the special problem of training oxen. Whenever part-time extension workers or "animateurs" are employed and expected to set a proper example in integrating animal husbandry and agriculture on their farms, these should also be given suitable training.

Prospects for Integration

172. The preceding analysis shows that the integration of agriculture and animal husbandry will encounter many difficulties. The development of this policy can therefore be expected to yield only limited results over

short or medium periods. Its value, however, cannot be questioned and in the long run it represents the future of the country's animal production and exports.

Goals and Priorities

173. The main goal must be meat production; while available farm animals can and should be utilized for tractive power, that is only a secondary and complementary aim. Nor should significant results be expected from the use of organic manure and the rationalization of traditional grazing systems until "agro-pastoral" pilot programs have been tried on a village scale. The "fodder revolution" is subject to existing ecological and land use constraints and the lack of control over livestock inherent in the separation between herd ownership and management.

174. Under a program giving priority to meat production, which is made clear by sectoral report, the Sahel would generally specialize in breeding stock, and the Southeast and Southwest, south of isohyet 600, would be meat producers. The Mossi plateau, where conditions do not favor livestock production, would have no special role except in the raising of small stock. In areas where agriculture and animal husbandry are to be integrated, the specific operations to be carried out might be:

(1) The maintenance of cattle on the farm (as draft animals and for fattening), a priority objective in the Black Volta, Bobo-Dioulasso, Banfora, Gaoua, and Southeast ORDS; this has implications for the training of both farmers and rural artisans; it requires attention to all technical aspects including animal health, production of fodder and proper choice of equipment.

(2) The fattening of livestock in commercial feed-lots that are envisaged for the Banfora and Bobo-Dioulasso areas.

(3) Meat production in commercial ranches (possibly a ranch in the Banfora area).

(4) Pilot agro-pastoral programs on a village basis (especially in conjunction with the rational settlement of uninhabited areas -- the White Volta and underpopulated areas of Fada N'Gourma and Tenkodogo).

Effects of the Program

175. The potential results of a possible livestock program as a whole are examined in the special report on livestock. Here only a few comments will be made on the impact which a farm livestock program might have.

176. In 1965 there were about 4,000 trained draft oxen and in 1969 the number was about 6,500. (The goal should be to reach 25,000 to 30,000 head in 1980. If oxen were kept five years for traction and then fattened for slaughter in the following year, an average of 5,000 to

6,000 oxen would have to be trained each year by 1980.) One center can train eight pair in five weeks, working about seven months in the year, according to SATEC experience; this represents about 100 head trained per center per year. Some 50-60 centers would thus be needed to meet national requirements. (If about one-sixth of the total of oxen kept on farms, i.e. between 4,000 and 5,000 were fattened for slaughter every year and fattening produced an increase of about 30 kg (carcass) per head, the additional yearly meat production due to the program would be of the order of 126-150 carcass tons, valued at CFAF 12.6 to 15 million by 1980.) No figure can be cited for the value added to crops through the use of 12,500 - 15,000 teams of oxen.

177. The feed-lot operation that might be established near Banfora or Bobo-Dioulasso could produce 12,000 - 16,000 head per year, or 1,800 - 2,400 tons of meat (carcass) weight. The ranch proposed for the Banfora region might produce about 5,000 head per year, or 700-800 tons of meat. The possible results of livestock projects that might be carried out within the framework of agro-pastoral programs organized on a village basis (especially in settlement areas) cannot even provisionally be evaluated until studies are completed and pilot programs for integrating agriculture and livestock-raising at the village level have been tried out.

178. It will be noted, despite the vagueness of the figures, that the programs that can now be undertaken in the areas best suited to the integration of agriculture and animal husbandry (the Southeast and Southwest) would have a limited economic effect. In 1980, 30,000 head would be integrated in agriculture-livestock programs (with primary emphasis on draft animals) in areas where the total cattle population would then be over a million. The social impact would be stronger, however, since the 10,000 farmers involved in the program would demonstrate what could be done and would by their example accelerate its expansion and extension to other favorable regions. The extension workers will have to be trained therefore in the techniques of integrated agriculture and animal husbandry.

C. Means and Methods of Action

Better Distribution of the Agricultural Population 1/

179. When the population density exceeds 40 per square kilometer in the ecological conditions prevailing in the most heavily populated areas of Upper Volta, the balance between the area under cultivation and the area lying fallow is upset; fields cannot be fallowed long enough to restore their fertility adequately; the farmer must then plant even more food crops to cover the minimum needs of his family in spite of the decline in yield, again reducing fertility.

1/ See Annex 1, Table XIV.

180. Any improvement in agriculture thus becomes increasingly difficult; the land shortage hinders the development of cash crops which would supply funds for buying the fertilizer and equipment needed to offset the exhaustion of the land; the vegetation on what little fallow land there is is much too sparse for stock-feeding. Traditional agriculture thus tends to become stabilized at a very low level of productivity in spite of much hard work and effort, as in Yatenga. In these conditions, any development program must be heavily subsidized, since farm income cannot pay the real cost.

181. Better geographical distribution of farmland would be one way of making better use of the two essential factors in agricultural production in Upper Volta--land and labor. Most farm families should have land enough to enable them under the traditional farming system to make profitable use of the improved methods devised by agricultural research, viz., 4-5 hectares under crops and 15-20 hectares fallow for a family of ten.

182. Demographic pressure in heavily populated areas has already forced some farmers out into regions where there is free land. However, this migration has been insufficient, since farm density continued to increase in the most over-exploited regions. The flow of migrants must therefore be organized on a scale commensurate with the seriousness of the problem.

183. Population statistics show that in 1970 the density is over 40 per square kilometer in 13 cercles covering 36,000 sq km and having a population of 1,620,000 rural inhabitants (33% of the total agricultural population). These cercles are located mainly in the Ouahigouya, Ouagadougou, and Koudougou ORDs and in the future ORD of Koupela. By 1990 this population density will be reached in 20 cercles covering 50,000 sq km and counting 3,290,000 inhabitants, or 48% of the agricultural population. Unless the present system of production is changed in respect of both area cultivated and yield, more than a million people will have to be moved in 20 years merely to maintain the present availability of land per farmer; if a density of 40 per square kilometer is nowhere to be exceeded in 1990, some 1,300,000 farm dwellers will have to resettle, involving the establishment of nearly 150,000 new farms in lightly populated areas over a period of 20 years. This situation shows that a better distribution of the population shall be a priority objective of Upper Volta's agricultural development policy.

Gradual Diversification of Programs

184. The number of specific measures undertaken to improve agricultural production in one region should be limited during the early years of a development program. Concentration on a few points will make it easier to get the farmers' cooperation. This is also necessary so long as there is not enough qualified extension personnel and the effectiveness of the proposed methods for improving output has not been clearly demonstrated. Later, however, these programs should be expanded to cover both new methods to raise the production of crops already included in the program and

measures to improve the output of other crops. These new programs should seek to maximize the benefits from the first improvements or to eliminate bottlenecks due to the increase in production.

185. Thus in Upper Volta the program for developing cotton production seeks in the first instance to promote earlier sowing at proper densities per unit of area. Once this has been achieved and the yield has been doubled (from 200 to 400 kg per hectare), the application of insecticides (increasing yields by 100 kg per hectare) and of fertilizer (increasing yields by 300 kg per hectare) become justified. Sorghum yields will then also be improved through the residual effect on this crop of the fertilizer applied to cotton. Similarly, whenever the area cultivated is large, the need for reducing the time required to prepare land for sowing will justify the use of a plow which can further raise yields by breaking up the soil more effectively.

186. The use of high-yield hybrid sorghums would make it possible to reduce the area required for food production. The land and labor thus released could then be used to grow industrial crops; this possibility would be particularly promising in highly populated regions where every opportunity to reduce the area in food crops should be utilized, either to increase pasture land or to introduce new commerical crops.

187. The choice of the initial content of any development program will depend on:

(a) Existing markets at home and abroad. The domestic market can absorb large quantities of food products, especially sorghum, some of which can now, as the result of recently perfected techniques, be used to replace imports of wheat milled in Upper Volta.

(b) The economic benefits of methods for increasing production devised by agricultural research for recommendation to farmers. From this point of view, the growing of food crops is clearly at a disadvantage compared to the production of export crops (cotton, ground nuts), which explains why export production programs have had much greater success.

Need for Central Government Control and Integration of Technical Sources at the Regional Level

Central Government Control

188. After several years of operation it appears that the establishment of the ORDs has in fact made it possible to carry out regional development programs and to achieve flexibility in the recruiting of staff and obtaining foreign financing. It much be acknowledged, however, that this kind of organization also has certain weaknesses which may become more

pronounced. The ORDs have come to depend on foreign companies (Societes d'intervention) which in practice decide on the programs to be instituted and the means to be used. There is no coordination of policies among the different companies or among the principal ORDs. The Voltaic staff does not seem capable of replacing the personnel supplied by the companies, at least in responsible positions, and consequently does not appear to be qualified to introduce new programs in the future. Finally, confronted with this situation, which is aggravated by dependence on multiple sources of financing, the central organization responsible for rural development has become progressively weaker. This deterioration is likely to jeopardize both the introduction of new programs to meet pressing national needs and the preparation, promotion, and coordination of specific plans and projects.

189. It therefore appears desirable to strengthen the central government control while retaining the decentralized structure of the ORDs.

(a) Widening the competence and enlarging the staff of the Direction du Developpement Rural (DDR - Rural Development Service)

(b) Establishing at the DDR level a nucleus of highly qualified personnel responsible for drawing up, evaluating, and coordinating the projects carried out by the ORDs. This unit would serve as intermediary between Ministry of Planning and the ORDs.

(c) Selecting and training Voltaic staff to work on this level of responsibility

(d) Developing closer control of ORD budgets and programs and direct negotiation with sources of financing so as to adjust programs in the light of the evaluation, with or without the assistance of the Societes d'intervention, of the results obtained by the ORDs.

190. The establishment of evaluation norms (e.g. the gradual reduction of the cost of extension services per kilogram of cotton, the relationship of increased yields to measures taken, etc.) would make it possible to compare the effectiveness of the ORDs, to assess the justification for additional funds requested, to readjust their programs and means for carrying them out, and to penalize the waste and poor results that may have characterized them, or, conversely, to encourage them in their successes.

The Integration of Technical Services on the Regional Level

191. The legislation defining the tasks of the ORDs made them responsible for all aspects of regional development and provided that they could draw for this purpose on the staffs of the appropriate technical services

in their regions. Only problems of regulation (public health, animal health, control of hunting and forest exploitation) and those of national interest (statistics, research) were to remain under the direct control of the central services. The coordination of the various activities was made the responsibility of the ORD Steering Committee, on which the central service as well as the local governments and the regional administration were to be represented.

192. The ORDs have in fact dealt primarily with the most urgent problems -- agricultural extension and farm credit -- for which they have had qualified staff available, drawn from the administrative services or recruited directly. Their activity has been much less important in the fields of infrastructure (construction of roads and development of irrigation schemes), equipment (silos), and marketing. Staff with expert knowledge in these fields is rare in Upper Volta and is still attached to the Ministry of Agriculture (the Hydrological and Rural Equipment Service) or to the Ministry of Planning and Public Works. Although these services were supposed to take action at the request of the ORDs, their collaboration has in reality not been as regular as could have been desirable. Requests from regional officers have gone unanswered. In Fada N'Gourma, for example, the agent in charge of advising farmers in an irrigated area has long been unable to obtain assistance from the Hydrological Service in repairing the water intake on the dam. Conversely, irrigation schemes have been carried out before ORDs could get adequate participation from farmers.

193. This lack of coordination between the central technical services and those of the ORDs hinders the development of production which depends not only on agricultural extension and credit but also on action in wider fields. The activity of the specialized technical services must be better coordinated with that of the ORDs. To be sure, the shortage of specialists makes it impossible to assign experts in all the desired fields to each ORD. It would be wise at first to give the ORD agents supplementary training in those fields other than agricultural extension that are most useful locally (irrigation, animal health, etc.). At the same time, the programs of the central services could be drawn up on the basis of those of the ORDs. Representatives of the central services sit on the ORD Steering Committees, so that coordination of this kind should raise no major difficulties. Also, when a central service is requested to undertake some action in the field, its agents should for this purpose be temporarily assigned to the ORD concerned. These measures would enable the ORDs to take more effective action with respect to aspects of their development programs.

The Cost of Extension Services

194. The successful realization of agricultural development programs will require a strengthening of the agricultural extension effort. Present methods, despite the drawbacks emphasized elsewhere, should not be altered but merely applied more effectively. In particular, the role of the "animateur" who is in direct contact with farmers should be strengthened

as demonstrated by the results obtained by CIDR and IRHO. There must be separate tough necessarily complementary corps of "animateurs" and "vulgarisateurs". The first, who are members of the rural communities with whom they work, are primarily concerned with the promotion of general receptivity to change. The latter, who are the extension agents proper ("encadreurs de base" or farm-level extension worker), concentrate on practical technical advice where some degree of receptivity has developed. These receptive qualifications and sources of recruitment might be summed up as follows:

	"Animateur"	"Vulgarisateur" (Extension Agent)
Age	30 years minimum	20 years minimum
Origin	Village or neighborhood	Region itself (if possible)
Place of residence	Village	Village or nearby
Selection	Chosen by sector chief, approved by village	Training and competition
Technical level	Good farmer	Technical training
Personally active in farming	Required	Desirable
Contract	Part-time	Full-time

The part played by "animateurs" may be expected to decline gradually in importance as farmers become adequately trained and organized. In expectation of this trend it is thus essential that "animateurs" be paid mainly in the form of premiums for results obtained and be prevented from becoming quasi civil servants.

195. The optimal density of extension services has been estimated, taking into account past experience. It is strongly recommended that the base of the pyramid be broadened by raising the ratio of farm-level workers to supervision. The staff that would be necessary if all of Upper Volta were to be covered is shown in Table 23.

Table 23: THEORETICAL EXTENSION STAFF REQUIREMENTS

Grade	Number of farms per staff member of each grade	Total staff, 1980
Farmers a/	-	700,000
Animateurs	50	14,000
Vulgarisateurs b/	250	2,800
Subsector chiefs	1,750	400
Sector chiefs	12,250	57
ORD chiefs	-	11

a/ There were about 500,000 farms in 1969. The number is expected to rise to 700,000 as a result of population growth and through the accelerated break-up of existing large families.

b/ There are now 650 "vulgarisateurs".

On this basis an average of 280 "vulgarisateurs" and 1,400 "animateurs" would need to be trained per year (or retrained in the case of present "vulgarisateurs") over the ten-year period.

196. The annual operating cost of such an extension service, including wages, social security, car operation, and miscellaneous costs, might be estimated on the basis of the present outlays by CFDT, at around CFAF 3 billion (see Table 24).

Table 24: ESTIMATED COST OF COMPREHENSIVE EXTENSION LEVEL

Type of staff	Annual cost per staff member (million CFAF)	Number of staff	Total cost (million CFAF)
ORD Chief (Volta national)	4	11	44
ORD administrative personnel	3	22	66
ORD technical personel	3	66	198
Sector chiefs	3	57	171
Subsector chiefs	0.5	400	200
Vulgarisateurs	0.25	2,800	700
Animateurs	0.12	14,000	1,680
Total			3,059

This would work out at CFAF 4,350 per farm. A proper measure of cost of the extension program is of course difficult to devise. Some conception, however, can be given on the basis of certain hypotheses. It may be assumed that without an extension program, agricultural production would increase at an annual rate of only 2 percent, raising it to a value of CFAF 25.4 billion by 1980 (base year 1966 = CFAF 19.4 billion). If, on the other hand, it is assumed that an extension program would raise production at an annual rate of 4 percent, starting from a 1966 base, output by 1980 would amount to CFAF 33.6 billion. The increase in production attributable to extension services could thus be put at CFAF 8.2 billion in 1980, as compared with an expenditure on extension of about CFAF 3 billion, or 36 percent of the value of the additional production. After 1980 the cost of extension services would be expected first to remain stable and then to decrease as the number of "animateurs" gradually declined.

197. In view of the high cost of such a program, Upper Volta, with its limited financial resources, can hardly afford to provide extension services to cover the entire country, all the more because a compensating reduction in the "density" of the extension network would unduly impair its

efficiency, at least for the next ten years. It thus appears that Upper Volta must set priorities in each ORD and concentrate its resources in the areas with the highest potential, particularly if the concept of "optimum density" is not to be sacrificed in favor of a rather thinly manned, dispersed and rather ineffective extension effort.

Organization of Producers

198. Pilot experiments in Africa, especially those conducted in Upper Volta by CIDR, make clear the effectiveness of organizing producers into groups. Since attempts to transplant European-type cooperatives (which have always been considered by most African farmers as being managed by personnel directed by Governments) have failed, such groups must be small, must be indentified with the traditional units, which can give some authoritative directions to them, and must initially have simple goals capable of enlisting the interest of producers (such as the "stores" of CIDR). These groups must in fact be "precooperatives"; their development must be gradual. They should have proper liaison with the extension service, but they must, above all, remain in intimate contact with farmers and their efforts must be persevering. This calls for dedicated personnel, who will be in touch with farm groups over a long period of time. This condition is at the same time a limit on the large-scale extension of a CIDR-type program. The grouping of farmers remains nonetheless the key to certain operations, especially pilot projects for integrating agriculture and livestock-raising within the framework of the agro-pastoral village schemes mentioned above.

Farm Price Policy

199. The relatively small domestic trade in basic cereals takes place on a completely free market. The more solvent merchants try to stockpile products for eventual sale at considerably higher prices during the period of shortage just preceding a new harvest. The organization or marketing and storage under ORD control would undoubtedly make it possible both to prevent speculation during shortages and to promote the sale of producers' surpluses at prices more profitable to them. Without going so far as to set up state marketing monopolies, the results of which are usually disappointing, the ORDs could be authorized to control sales by approved dealers, to make adequate storage facilities available to them, to stabilize prices in some degree by a supply equalization scheme set up with the assistance of the World Food Program, and to conclude marketing contracts with merchants subject to adherence to specified farm prices and consumer prices.

200. For export crops, notably cotton, it has not always been easy to reconcile the need to pay farmers prices that provide adequate incentives and the necessity of marketing exports at competitive world market

prices. Thus, quite apart from the cost of extension services, the Caisse de Stabilisation des Prix (CSP) has had to subsidize the farm price of seedcotton. On the 1968 cotton crop, for example, it incurred a loss of CFAF 116 million (CFAF 76 million after taking into account an offsetting profit on cotton seed) on the export of cotton even though farm prices that year were somewhat reduced. Fortunately the partial devaluation of the CFA franc in August 1969 has made it possible to realize a higher export price in terms of CFA francs without a corresponding increase in farm prices. This greater spread between farm and export prices, together with a new arrangement, more favorable to the Government, for the sharing of profits from the purchase, ginning and export of cotton between CSP and CFDT that is to become effective in 1970, should make it possible to dispense with price subsidies over the next few years. However, in view of the projected decline in world cotton prices, it is likely that a renewed and growing deficit will appear beginning in 1973, unless farm prices are correspondingly reduced.

201. Under these conditions a gradual decline in the cotton prices paid to producers must be envisaged, all the more because continued foreign financing of the agricultural extension services is uncertain and the Government must be prepared to finance an increasing part of the cost. Thus adequate economic incentives for the production of cotton, an eventual cash crop for Upper Volta, can be provided only through substantial yields. This is the only possible way of increasing peasant income in the face of the unavoidable decline in producer prices. The production goal of 120,000 tons of seed cotton in 1980 must be reached by raising yields from 425 to 750 kg per hectare and by increasing the area in cotton from 80,000 to 160,000 hectares.

Reorientation of Financing

202. In a country poor in natural and financial resources like Upper Volta, public financing available either from abroad or from the national budget must be used:

(a) For productive activities which will bring the largest increase in individual farm income;

(b) For projects requiring the smallest recurrent expenses to the Treasury, or, in the case of foreign financing, for the project the cost of which can be borne by the national budget or directly by the producers when foreign aid ceases.

203. On the basis of these criteria, it is clear that financing of rural development in Upper Volta must meet the following conditions.

(a) The traditional distinction between investment and recovering operating expenditure must be dropped. Financing of the operating expenditures of certain government services (including those financed from foreign aid) in fact are often likely to yield sizeable increases in production, and thus in individual incomes. This is true, for example of the livestock service, which, if it had the means (vehicles, vaccines, etc.) could greatly improve the health of the cattle population and increase the rate of offtake from existing herds. This is especially true of the Agricultural Extension Service, where effectiveness directly determines the increase in farm production that can be achieved.

(b) Priority in allocating funds must be given to the opening up and development of the uninhabited or sparsely populated areas in the Southwest, the Southeast, and the Volta River valleys of the Center, which now offer the highest potential for development; this means, however, that few funds should be devoted to the Mossi plateau where development can produce only marginal economic results, in view of difficulties of all kinds which inflate costs and minimize profits.

(c) Prompt financing should be provided for small projects likely to improve the economy of a restricted area. Among these are the provision of small storage facilities, the improvement of rebuilding of access roads to open the way for production and facilitate marketing, simple schemes for developing bottom land for rice-growing, etc. Such projects, as identified by the ORDs, could be appraised by an Agricultural Projects Office under the National Development Bank and could then be financed and supervised by the Bank.

(d) There must be a gradual reduction in the cost of foreign technical assistance now privided to the ORDs, so as to enable the Voltaic budget progressively to replace foreign financing which cannot -- and should not -- be expected to continue indefinitely. The training of competent and experienced Voltaic personnel is one of the best ways of reducing these costs in view of the large wage differential between local and expatriate supervisory staff.

D. Possible Projects

Raising Production in the Uplands

204. A well documented study 1/ has shown that possibilities for diversification are limited. The introduction of new crops, except under such schemes as have already been prepared or are being carried out, hardly seems possible.

205. The low natural fertility of most soils can never be much improved, since it is due to their geologic origin and the existence of hard lateritic pans. However, the utilization of such soils could be much improved. The fallowing of land under natural vegetation is and will long remain the only practical means of restoring cultivated soil, since it is effective and does not require extra work or expense. There has never been a detailed study on the extent to which soil fertility varies in accordance with the duration of fallow. It would be very useful to make a study bringing together all research previously done in comparable physical and agronomic conditions. This would make it possible to program further observations for the purpose of determining the optimum duration of the fallow period which is now estimated to be at least four years. On the basis of the latter estimate and the evaluation by ORSTOM of aerial photographs taken in 1960, the areas that are already excessively exploited and the areas where land is still available can be delimited. A program for settling the under-utilized areas is practically the only means of preventing the gradual deterioration of cultivated land in regions where the population density has already reached 30-40 per square kilometer.

206. In high-density areas, natural fallow land can be improved by supplementing the spontaneous vegetation with quick-growing types of cover crops (stylosanthes and bracharia in the rainiest areas, andropogon or other local grasses elsewhere). It will be hard to gain acceptance for this program, since the effects are not spectacular and farmers may well shrink from the extra work entailed except in regions where they have difficulty feeding their stock; moreover, it will be necessary to eliminate or control grazing on common land in order to give the more dynamic farmers the opportunity to profit from their own initiative in growing such cover crops. However, if land could be improved in this way, it would be possible to avoid a reduction in fallow and an expansion in the area under cultivation and to raise output.

207. In the immediate future, the annual application of mineral fertilizer is the only possible way to increase soil fertility; cash crops

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1/ Kellerman Report, FAC, 1967.

(groundnuts and especially cotton) can easily bear the fertilizer cost if sowing is at the correct time and density. On the other hand, the use of fertilizer on food crops is justified only in exceptional cases (Yatenga) when it can obviate the need for even higher expenditures on foodstuffs during the period of shortage preceding the harvest. But as the programs now being carried out make very clear, the use of fertilizer is never advisable unless general crop husbandry is good. This condition cannot always be satisfied for a variety of reasons, including difficulties in land preparation, poor health on the part of farmers early in the rainy season, and the over-extension of the area under cultivation as security against depredation by animals.

208. The techniques already perfected by research institutes for sorghum, rice, groundnuts, and cotton could double average yields. The chief problem is thus to obtain acceptance of these new methods by the peasants by means of a well organized extension program. The results of such programs must be followed closely to find the causes of difficulties encountered by extension agents; it will then be possible to increase the effectiveness of the extension services. The most difficult point seems to be the sowing date, which still comes much too late in the year in many cases. This problem has never been permanently solved in tropical Africa because of the lack of sufficient equipment to prepare the land. The results obtained for cotton are already satisfactory; if peasants were assured a supply of cereals sufficient for their needs, they could give more time to cash crops in areas favorable for their cultivation.

209. Some degree of regional specialization of production would be useful if a marketing network were set up. The East and Southwest, where export crops are of little importance, could supply cereals to the central regions where cotton-growing is being developed. In addition, the formation of reserve stocks would stabilize cereal prices between seasons, as has been proved by the Yatenga ORD on a small scale. Existing silos could provide the initial basis for a more sustained effort.

210. The introduction of these various improvements might lead to "productivity programs" sponsored by the ORDs. These would call for specific measures which could be financed through agricultural credit (fertilizer programs, improvement of natural fallow, seed and sowing programs). They entail some uniformity of extension methods and more thorough staff training. These programs should focus especially on the preparation and execution of small-scale projects for improving production and marketing (small irrigation schemes, improvement of access roads, provision of storage facilities, etc.).

Development of Water Resources

211. Deficiencies in rainfall and its regularity can be overcome only through irrigation. Agriculture without irrigation will always be risky, even if varieties with maturation periods well suited to local conditions are chosen.

212. Irrigation can be developed in two ways, which have already been tried in Upper Volta. One is the development of an irrigated area in which water distribution is perfectly controlled. The cost of this type of scheme is high and is likely to be justified only on the basis of very intensive methods of cultivation to which farmers are not accustomed. The distribution of water over the developed area calls for strict discipline, hard and painstaking work, and training in difficult operations; and generally such fundamental changes in working habits can seldom be effected in less than a generation.

213. Another method would be to improve the present utilization of bottom lands (bas-fonds). The first step would be to choose land where such projects could be carried out, judging by local experience, i.e. land where flooding is most regular and least violent. In such areas, simple improvements (drains, embankments) could make it possible to control flooding to some extent. At the same time the selection of varieties with maturation periods well adapted to the depth and duration of submersion and the transplanting of seedlings from irrigated nurseries could reduce the risk of poor yields. The farmers themselves could carry out such projects at comparatively low cost provided they realized the need for them and were given the necessary technical assistance; they could be realized in the most heavily populated regions where the land shortage is forcing farmers to use all available resources. Since the growing season in bottom lands starts after that in the uplands, because the bottom lands must first be flooded, it should be possible to schedule agricultural operations in such a way as to make better use of available farm labor without upsetting the traditional pattern of agriculture. After their gradual initiation into water management, the peasants could move more easily toward the controlled irrigation which should have an important place in Upper Volta in the very long run.

214. The development of the bottom lands should therefore be encouraged. The Water Resources and Rural Equipment Service 1/ should make a rapid study of their possibilities in places where peasants want to grow rice (rapid topographic survey, analysis of available information on flooding, study of drainage basins). It should draw up plans for their rapid development (rechanneling of river beds, flood control, size of embankments needed to retain water at the end of the season, varieties to be grown); and it should help farmers to carry out the necessary work.

215. Irrigable areas downstream from existing dams should be developed where practicable at the lowest cost. A study of the flood discharge from reservoirs will show whether flooding can be controlled through modest investments or whether it would be more economical to confine cultivation to the dry season. Irrigation canals should generally not be lined with concrete. No project should be undertaken unless the beneficiaries are

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1/ Service de l'Hydraulique et de l'Equipement Rural.

really willing to help carry it out. Meanwhile, no new dam should be built until all areas that can be irrigated from existing reservoirs have been developed. Wells will be a more economical source of water for men and animals.

Settlement of Uninhabited Areas

216. The settlement of uninhabited or sparsely populated areas in the East and Southwest and in the valleys would make it possible to use land now unutilized and to combat the gradual exhaustion of the land on the neighboring plateaus by obtaining for young farmers other cultivable fields than the fallow which is already too limited to provide a good yield on the overpopulated highlands. The number of settlers should be at least equal to the natural increase in population in regions where population density is in excess of 40 per square kilometer.

217. Although spontaneous migration by farmers has been and is still frequent in tropical Africa, especially in Upper Volta, where the establishment of new farms is often quite recent, experience has shown that organized settlement projects are always very difficult. For these operations to succeed, the more enterprising farmers must be encouraged or persuaded to move, and their resettlement must be facilitated under conditions that make sure that they will encounter no insurmountable difficulties, but that will at the same time not impair their enterprise through excessive assistance and controls. If this is not dones, the State will have to pay out considerable sums to compensate for the lack of enterprise of settlers who cannot or will not make the necessary effort to establish their own farms. (Cf. Annexes 5 and 6.)

218. Of all the valleys, that of the White Volta has the best soil for this purpose; of a total of about 5,000 sq km, 1,600 sq km are considered good and 3,000 sq km fair. The operation will be difficult, but the production potential would appear to justify a major effort. Available information shows that this area, once more thickly settled than it is now, was abandoned primarily because of disease (onchocerciasis and trypanosomiasis). The first step is to ensure that there will be an effective campaign to eradicate the flies that are the carriers of these two diseases, particularly the vector of onchocerciosis. The possibilities for development must then be assessed in the various zones where colonists could settle without excessive risk to health. Last, the movement and settlement of the colonists will have to be organized.

219. A general development plan must first be drawn up, with a detailed program for the first pilot project. Settlement should then be expanded in the light of the experience obtained in the pilot project which will be the starting point for new schemes. For each successive stage of the project it will be necessary to define, in accordance with the program outlined in annex 5:

(i) the infrastructure required (roads, schools, hospitals);

(ii) the farming systems to be introduced (crops and livestock);

(iii) the organization of production (training, extension services, credit, supplies, marketing);

(iv) the estimated costs and benefits.

220. On the sparsely settled plateaus of the East and the Southwest, the production potential does not justify a costly program. Farming methods are much like those in the areas of origin of the settlers. Technical research should therefore take little time and be based principally on existing data, supplemented by a rapid soil survey to eliminate soil too poor to farm. Traditional rights to the land to be settled must be determined to avoid conflict between the old and the new population. Sociological data will make it possible to choose regions where there are already settleers with ties between social groups in the new and the old areas, and will help to determine the specific manner of migration and the aid to be given settlers.

221. The Diebougou-Gaoua area has a definite productive potential which has led the Voltaic authorities to consider strengthening the development program already begun there. Since 1963 the CIDR has been carrying out a program with modest funds which has yielded interesting results and familiarized nearly 5,000 farmers with new farming techniques. A more comprehensive development plan for this area, taking into account both the prevailing constraints and the potentialities, should be prepared. It might provide additional opportunities for the settlement of farmers from the overpopulated areas of the Mossi plateau.

222. The region of Fada N'gourma in the Southeast, where present density is not more than five inhabitants to the square kilometer and where there is plenty of good land, could also be an outlet for the excess agricultural population of the Mossi plateau. A development plan providing for the building of access roads and the provision of technical extension services should be prepared over the medium-term for this region. At an early date, the Koupela ORD, which is densely populated except for the cercles of Tenkodogo and Bogande, and is directly north of Fada N'Gourma, should be provided with extension services and other facilities which would enable it to serve as a corridor of migration to the Fada region.

223. Both projects are considered priority goals by the Voltaic authorities, who hope that the World Bank will be interested in financing them. However, much more study of the technical and economic aspects of these projects is necessary before they can be considered for financing.

IV. CONCLUSIONS

224. Possibilities for agricultural development are limited in Upper Volta. The poor soil, the dry climate, the uneven distribution of the population, the lack of qualified staff, and the stortage of domestic financial resources, all contribute to the difficulties and slowness of efforts to raise production. Some progress has been made, however, and on this basis it is possible to give some indication of the principal lines along which a relatively modest program, taking into account existing constraints, can be worked out.

225. Priority should be given to promoting a better distribution of population, so that use can be made of the two essential factors of Voltaic agricultural production, land and labor. Demographic pressure on the Mossi plateau must be relieved as much as possible by encouraging and accelerating migration and developing the areas of good agricultural potential in the least-populated regions (the Southeast, the Southwest, and the valleys of the central plateau).

226. Within the framework of this priority, financing from all sources must be directed to projects and measures that will bring about the largest production increase without maintaining the traditional distinction between investment cost and operating or recurring costs.

227. Although certain ORDs now receiving massive foreign aid have obtained respectable results, their future remains problematical because financing institutions have made no long-term financial commitments. The termination of this assistance might permanently endanger current programs, which involve prolonged efforts to diffuse modern methods and to organize farmers and will therefore require competent staff for a long time. Upper Volta is not now capable of financing from its own budget programs that are not yet, and will not for some time be, financially self-supporting. Neither can the country cut the cost of such programs, since it does not have sufficient qualified staff of its own that would enable it to dispense with the help of foreign technicians.

228. This shortage of staff is a determining factor not only in the operations already undertaken but, above all, in undertaking new projects. It would be dangerous to launch an agricultural development program without making sure that Voltaic personnel could take over from froeign specialists as soon as possible, especially since the profitability of potential production does not make it possible to bear the heavy cost of employing foreign staff for very long. A major effort should thus be undertaken to train national staff in the work to be done.

229. The shortage of available funds is a further reason for special care in the selection of goals and methods. Any project must therefore be studied very seriously to get a full appreciation of the factors involved in the problems to be solved and to compare the effectiveness of various

possible solutions. A large volume of data is available on general problems in Upper Volta, and it would seem redundant to add to it; it would be very useful, however, to centralize it in one office with copying facilities. Where specific rather than general data are needed for the preparation of a detailed program, on the other hand, few figures are available and objective assessments can seldom be made. After an exhaustive inventory of the data on hand and a national agricultural inquiry to bring together the essential general information, it would be possible, following the broad outlines set under the Plan, to organize a program of research focusing on the fundamental data required on regions where projects should be undertaken. The gathering of such data, their use, and the preparation of the projects should be assigned to a central team of specialists working with all of the Ministries concerned. The economic analysis of the projects should take account of the year-to-year variability of yield and weigh its effects on the funds available to farmers for repayment of loans.

230. The projects must be carried out very gradually so that the approach to the peasants, whose reactions are largely unpredictable, can be continually improved. No matter how carefully a project may be drawn up, it always involves a number of assumptions, especially in regard to participation by farmers and the ways in which they will use resources available to them. It is therefore important to record results regularly from the beginning, and to analyze them in order to adjust the programs accordingly. Such progress reports could have prevented several costly errors in Upper Volta. They cannot be made solely by those responsible for on-the-spot action, who are poorly situated to appraise the results of their own work and often do not have the time. Not only the preparation of projects but permanent control of their execution should be the responsibility of a team of specialists in the Ministry of Agriculture.

231. Experience shows that Voltaic peasants are perfectly capable of adopting new methods, either under the impulse of an extension program sustained over many years as in the case of cotton, which requires fairly advanced techniques, or on their own initiative, as in the case of rice, which is cultivated in a fairly rudimentary fashion. The spontaneous resettlement of Mossi farmers proves that they are trying by the only means at their command to solve the major problem of the land shortage in their area. Extension services and migration should thus be the principal factors in any program for agricultural development in Upper Volta.

232. Several projects might be planned:

(a) Projects in support of export crops should be continued. For food crops it would be useful to investigate the reaction of growers to high-yielding farinaceous sorghums. The possibilities for regional crop specialization should be studied in the interest of obtaining a better utilization of natural resources and more balanced national growth.

(b) Irrigation of natural bottom-land and of land downstream from existing dams should be developed where the population density is high enough for the peasants to realize the desirability of a kind of farming which is difficult but which makes it possible to exploit land which had remained unutilized as long as there was plenty of fallow. The introduction of irrigation where it has been unknown entails such a revolutionary change that very prudent action is required; any public investment that does not take into account the knowledge possessed by the farmers and the efforts they are willing to make is likely to remain unused and thus result in a loss of capital that would be better employed elsewhere. Emphasis should accordingly be put on small projects in which the local population is really interested and which can contribute directly or indirectly to an increase in production and marketing.

(c) The settlement of uncultivated land in the White Volta River valley and on the eastern and southwestern plateaus will relieve the over-exploitation characterizing the heavily populated areas. In many regions, the population density has reached a point where fallow land is no longer sufficient to maintain yield at an adequate level without very costly fertilizer applications and a radical modification of traditional farming methods. This type of intensification would be a long, difficult process, and it is by no means sure, on the basis of existing knowledge, that it would be profitable. Only the migration of a considerable proportion of the population is likely to provide the necessary means for keeping the amount of land available per capita at approximately current levels.

(d) Agricultural research and experimentation are absolutely essential. In addition to present research, which must be continued, two points should be studied:

(i) Use of the black clay soils which cover large areas of the White Volta River valley. Their fertility potential is high but their physical characteristics will make them hard to cultivate. They are little used so far in Upper Volta, and IRAT has only begun to experiment on these soils near Saria.

(ii) Methods and equipment for soil preparation with tractor-drawn implements. These would be very complex long-term experiments, since it would probably be necessary to devise entirely new equipment.

(e) Extension services to farmers should be continued and gradually broadened in terms of the scope and diversification of their programs wherever conditions are favorable. Extension programs should gradually be broadened to include specific measures for integration of livestock with farming (use of draft animals and farm fattening of cattle), the organization of precooperative peasant groups, the regrouping of cultivated areas and the rational utilization of fallow land for grazing herds, the maintenance of access roads, the improvement of bottom land suitable for rice-growing, and the digging of wells.

A N N E X E S

1. Statistical Tables

2. Characteristics of Agricultural Holdings

3. Activities in the Yatenga, Koudougou and Ouagadougou Areas

4. Price Structure of Export Crops

5. Study of a Project for Settling the White Volta Valley

6. Comments on a Program of Action against Onchocerciasis in Upper Volta and North Ghana

ANNEX 1 - STATISTICAL TABLES

Table I: LAND USE

	Hectares
Total area of Upper Volta	27,400,000
Area cropped 1/	
Sorghum) Millet)	1,400,000
Corn	150,000
Fonio and Misc.	50,000
Cotton	80,000
Rice	40,000
Groundnuts	100,000
Sesame	30,000
Total	1,850,000
Cultivated area per rural inhabitant	0.45 ha.

1/ Areas estimated from average yields and various sources. For the basic traditional crops, the reference year was 1966/67, a "normal year." For cash crops, the most recent available figures are those for 1967/68 for groundnuts and sesame, and 1968/69 for cotton. All data are approximations.

Table II - PRODUCTION AND USE OF SELECTED CROPS

(in '000 tons)

	Sorghum	Millet	Corn	Rice	Cottonseed	Groundnuts in shell	Sesame	Shea Kernels
Production	570	280	100	40	37	75	6	22
Domestic Consumption								
Seed and losses	11	6	2	4	2	4	-	-
Farm consumption	474	234	68	30)	3	56	3	4
Traditional domestic sector	85	40	30	4)				
Modern domestic sector (sold to industry)	-	-	-	2	-	3	-	3.5
Export (modern sector)	-	-	-	-	32	13	3	14.5

Notes: For sorghum, millet and corn, the figures have been based on 1966/67, a "normal" year; for sesame, groundnuts and sheanuts, the 1967/68 crop year, and for cotton, the 1968/69 crop year.

Sources: The following authorities and sources were consulted: (a) the official figures of the Ministry of Agriculture. (These proved unusable because of the disproportionate inflation of output figures since 1964); (b) the official estimates given in the Plan, which help to put the Ministry's figures in perspective; (c) an unpublished estimate by the Planning Ministry, which uses a collection factor by taking into account the trend over the past 15 years, rainfall and consumption; (d) the estimates contained in the national accounts of Upper Volta; (e) estimates for certain crops supplied by IRHO (oilseeds) CFDT, USAID (rice report), and the Kellermann report. The breakdown of production by destination is based mainly on a SEDES survey of 1966. For the record, changes in the production of sorghum and millet according to (a) the Ministry of Agriculture's official statistics, and (b) the unpublished Plan figures are set out below (in thousands of tons):

	Ave. 1959-62	1963	1964	1965	1966	1967	1968
(a)	640	769	1,035	1,254	1,189	1,176	1,300
(b)	-	-	786	772	750	660	656

Table III - VOLUME OF CASH CROPS MARKETED

('000 tons)

	1964	1965	1966	1967	1968	1969
Cotton						
Seed cotton marketed by CFDT (monopoly)	8.4	8.8	7.5	16.3	17.3	32.0
Cotton fiber exported	2.7	3.0	2.5	5.7	6.1	8.7
Cottonseed sold abroad	3.9	3.5	2.5	5.0	5.1	10.0
Groundnuts (shelled)						
Marketed thru modern sector	5.5	5.8	8.7	10.9	10.3	10.4
Exports	3.6	4.3	5.8	7.4	8.8	8.0
Deliveries to local industry	1.4	1.5	2.8	2.4	2.0	1.4
Sheanuts						
Marketed thru modern sector	15.1	1.6	18.7	0.01	20.8	14.8
Deliveries to CITEC	3.8	0.9	3.1	0.01	3.6	4.2
Exports	10.6	0.7	15.5	-	16.5	10.6
Sesame						
Marketed thru modern sector	2.3	2.4	1.7	2.6	2.9	2.7
Exports	2.1	2.4	1.7	2.3	2.9	2.5

Sources: Department of Trade CFDT and CITEC Reports.

Table IV - PRICE STRUCTURE OF AGRICULTURAL PRODUCTS[1/]

(in CFAF per kg)

	Sorghum Millet	Corn	Rice (Paddy)		Seed cotton		Groundnuts shelled	Sesame	Sheanuts
			1st grade	2nd grade	1st grade	2nd grade			
Price to Producer	12[1/]	13[1/]	19	17	32	28	25.75	26.75	7
Wholesale Price (Ouagadougou)			23	21[3/]	38.6	34.6	26.75	27.75	8
					Cotton fiber				
Processing, packaging					107.2	96.1	[2/]		
Export Price, ex Ouagadougou							32.34	33.37	12.75
Export Price, ex rail Abidjan							37.39	38.14	16.76
Export Price, f.o.b. Abidjan					140.1	129	39.64	40.37	18.60
Export Price, c.i.f. port of destination							48.60[3/]	50.27[3/]	(25.96[3/] (27.44[3/]

1/ According to the price schedules fixed by decree for the 1969/70 crop season.
2/ Groundnuts that are not exported are sold locally at CFAF 20 per kg., factory gate. Groundnut oil is sold at CFAF 9 per kg ex factory
3/ CFAF equivalent of prices c.i.f. French port for groundnuts, Italian port for sesame, and Japanese and Scandinavian ports for sheanuts.

Source: Department of Trade

Table V - PRICE STABILIZATION FUND: CROP YEARS 1965-1968

(CFAF million)

	1965/66	1966/67	1967/68	1968/69
Revenues				
Tax on Imports and Exports	79.0	86.0	92.6)	46.3
Levy on Sales of Oil	2.3	2.0	2.0)	
Refund on Exports 1/	6.5	2.9	64.5	194.6
Other revenue 2/	-	-	-	41.4
Total	86.8	90.9	159.1	282.3
Profit and Loss Account 5/				
Profits	6.6	20.0	19.9	(30.0) 6/
Balance to be carried forward	-	-	-	30.0
Outlay on Price Support				
Cotton	50.2 4/	92.2 3/	63.7	111.0
Groundnuts	2.4 3/	3.6 3/	65.9 4/	73.7
Sheanuts	46.2	-	-	-
Subsidy in CFAF per Kg.				
Cotton fiber 7/	21	16	10	12
Groundnuts, shelled	0.7	0.6	9	8

1/ The products on which refunds have been paid are the following: sesame (CFAF 2.5 million in 1967/68); sheanuts (CFAF 62 million in 1967/68); and seed cotton (since 1968/69).
2/ Repayment of loans by SOVICA - SOVOLCOM.
3/ Price guaranteed by France.
4/ Price not guaranteed by France since 1968.
5/ The Profit and Loss Account includes both balances and operations (notably credit operations such as advances for marketing paddy) not mentioned in the table above.
6/ Provisional estimate in parentheses.
7/ In 1968/69 the subsidy amounted to about 10 per cent of the price f.o.b. Abidjan paid by the purchasers.

Source: Ministry of Trade and Finance.

Table VI - AGRICULTURAL CREDIT, 1966-1969

1. Volume of Credit Granted	Short-Term	Medium-Term	Total
1966/67	51,306	98,297	149,603
1967/68	343,570	504	344,074
1968/69	455,896	76,406	532,302
Total - 1966-1969	850,772	175,207	1,025,879

2. Purpose of Credit

CFAF '000

	Short-Term		Medium-Term
Chemical Products	288,140	Animal-drawn equipment	70,587
Seed	17,882	Spraying equipment, etc.	31,934
Marketing	537,095	Purchase of animals	4,443
		Farm development	16,237
		Miscellaneous	63,731

3. Changes in the Cash Position (CFAF million)

	Total receivable[1]	Amount unpaid[1]	Percent unpaid[2]
Position on 9/30/65	27.16	0.58	2.1
6/30/66	25.48	13.15	56.6
6/30/67	44.67	23.60	52.7
6/30/68	50.23	28.56	56.0
6/30/69	51.82	13.87	26.76

1/ Including amount due in March of the year indicated.
2/ Col. 2 as percentage of Col. 1. It will be noted that the data on the breakdown of short-term and medium-term credits do not conform entirely with the total amounts of such credits.

Table VII - REIMBURSEMENT OF AGRICULTURAL CREDIT, JUNE 30, 1968

(CFAF million)

	Amount unpaid as of June 30, 1967	Payment Due	Receivable (Col. 1 & 2)	Amounts received	Amount remaining unpaid	Percent
Ouagadougou ORD (SATEC)	13,150,710 1/	9,046,650	22,197,360	5,870,600	16,326,760	73
Koudougou ORD (SATEC)	3,833,256 1/	7,354,164	11,187,420	5,243,733	5,943,687	53
Dédougou ORD (CFDT)	1,871,988	7,948,998 2/	9,820,986	7,021,516	2,799,470	28
Kaya ORD (CFDT)	18,052	1,995,989	2,014,041	1,866,687	147,354	7
CIRD Area (Bobo-Diébougou)	-	1,444,514	1,444,514	1,444,514	-	0
CFDT Area (Koupela)	19,887	114,922	134,809	66,557	68,252	50
Credit granted by SATEC outside its Technical Assistance Areas	1,927,805 3/	1,505,339	3,433,144	154,659	3,278,485	95
	20,821,698	29,410,576	50,232,274	21,668,266	28,564,008	56

1/ Including short-term loans for 1966 in the SATEC Area.
2/ Including moratoria amounting to CFAF 634,098 because of unusual drought.
3/ Amounts previously included in data for Ouagadougou ORD.

Source: Table submitted by National Development Bank. The table gives no information for Yatenga (BDPA).

Table VIII - INVESTMENT IN DAMS - 1956-1966[1/]

Source of Funds	No. of Dams Built	Total Cost of Works (CFAF million)	Eventual area Susceptible of Irrigation (hectares)
FIDES	7	130.20[2/]	1,035
FERDES	3	9.10[3/]	15
FAC	21	574.80[4/]	355
FED	40	915.22[5/]	702
TOTAL	71	1,629.32[6/]	2,107

1/ No. new dams built after 1966.
2/ Cost of six dams. Cost of seventh not known.
3/ Cost of one dam.
4/ Cost of 17 dams. Cost of other four not known.
5/ Cost of 31 dams. Cost of other nine not known.
6/ Cost of 55 dams. Average cost was thus approx. CFAF 30 million per dam.

Source: Service de l'Hydraulique et Equipement Rural.

Table IX - FINANCING OF DEVELOPMENT PLANS IN ORD AREAS - 1967, 1968, 1969

	Total	Financing from abroad		Domestic Financing
Black Volta ORD (CFDT)[1]	452.6	FAC	184.4	268.2
Kaya ORD (CFDT)[1]	453.2	FAC	364.5	88.5
Ouagadougou ORD and Koudougou Area (SATEC)[2]	819.5	FAC	715.9	173.6
Gaoua ORD (CIDR)[1]	68.0	-	-	68.0
Banfora ORD (SOTESA)	...	FED	...	...
Yatenga ORD (BDPA)[2]	218.3	FED	180.0	38.3

Sources: 1/ Planning Division.
2/ Reports and Accounts of Sociétés d'Intervention.

Table X - COST OF OPERATIONS IN ORD AREAS

(CFAF million)

(a)	Groundnut Expansion in the Bobo-Dioulasso and Banfora Areas (IRHO)			
	Financing 1960-1967	45.03	of which FAC	41.70
			National Budget	3.33
	of which, 1967	7.23	of which FAC	5.99
			National Budget	1.24
(b)	Yatenga ORD (BDPA)			
	Financing 1965-1970	325.7	of which FED	269.00
			National Budget	56.70
	of which, 1969	33.07	of which FED	14.28
			National Budget	18.79
(c)	Financing of extension activities (animation) (CIDR)			
	Houndé, Boromo, Bobo-Dioulasso and Diebougou Districts, Gaoua ORD			
	Financing for CIRD 1968-1969	38.43	of which FAC	12.93
			National Budget	21.00
			Misc.	4.50
(d)	Ouagadougou and Koudougou ORDs (SATEC)			
	Financing 1961-1969	1,245.18	of which FAC	1,280.00
			National Budget	215.07
	Financing Koudougou ORD, 1970	114.82	of which FAC	64.31
			National Budget	50.51
(e)	Black Volta and Kaya ORDs (CFDT)			
	Financing 1967-1969	905.8	of which FAC	548.9
			National Budget	356.9
	of which Black Volta ORD, 1969	138.4	of which FAC	97.5
	Kaya ORD, 1969	171.2		52.0

Table XI - SOURCES OF CAPITAL FOR AGRICULTURAL DEVELOPMENT

A. European Development Fund (FED)

Commitments	$ '000	Comments
1960	380	Construction of three dams
	158	Water for humans & flock
1961	1,562	Eight earth dams
1962	7,112	Dams
1965	960	Yatengo Development
1966	393	River Blindness Campaign
1966	122	Rural Wells
1967-1969	140	Banfora Development
Total	10,827	

B. UNDP - -

C. Bilateral Aid

	CFAF million	
United States	6	Water Resources projects
West Germany	125	Infrastructure work at Bam Lake
China (Taiwan)	ca.600	Development of Boulby, Louda, and Kou irrigation schemes

D. IBRD

Financing of development of Black Volta and Bobo-Dioulasso ORDs envisaged

E. FAC

Years	Total allocated to Rural Development (Fr. francs '000)	Percentage of FAC Programs in Upper Volta
1959	4,172	18.21
1960	8,953	35.50
1961	10,259	49.40
1962	10,502	48.26
1963	11,847	50.05
1964	6,927	33.11
1965	24,017	77.40
1966	13,532	58.82
1967	14,891	45.92
1968	14,781	51.58
10 years	119,881	47.85

Source: Data on the use of FAC Credits during the period 1959-1968 (Feb. 1969).

Table XII - BANFORA SUGAR PROJECT

1. Estimated cost of Establishing the Plantation

CFAF million

Outlay by Upper Volta Government		Outlay by SOSUHV	
Land (expropriation)	100	Agricultural equipment and vehicles	170
Water supply	600	Irrigation	300
		Land clearance	100
		Initial planting	110
		Sheds and stores	27
		Laboratory, offices	20
	700		727

2. Breakdown of Price of Sugar Produced in the Banfora (cube sugar) Refinery

	Cost	CFAF per kg
Price at Frontier		42.00
import duty	0.40	
transport	1.10	
Price to Factory		43.50
processing	18.39	
Price ex Factory		61.89
Local tax	7.10	
Transportation (equalization)	2.51	
Price Delivered anywhere in Upper Volta		71.50
Wholesale margin	3.50	
Wholesale Sale Price		75.00
Retail margin	5.00	
Retail Sale Price		80.00

Source: SOSUHV, Banfora.

Table XIII - PROJECTIONS

A. Possible production targets for 1980

	Sorghum[1]	Millet[1]	Corn[2]	Paddy[3]	Cotton	Groundnuts	Sesame	1000 tons Sheanuts
Actual Production 1968/69	560	270	100	40	37	75	6	22
Growth Assumption (per cent per year)	2.1	2.1	4.0	Double by 1980	CFDT Target	2.1	-	-
1980 Target	700	340	160	80	120	90	?	?

B. Population Forecasts[4] (in thousands)

	1965	1969	1970	1975	1980	1985
Total Population	4,719	5,030	5,127	5,657	6,330	7,137
of which:						
present rural population	4,162	4,410	4,501	4,944	5,505	6,180
present urban population	272	320	321	382	460	554
emigrant population	285	300	305	331	365	403

1/ Growth rate assumed equal to that of population.
2/ Growth rate assumed to be twice that of population, taking into account rising consumption requirements.
3/ On the following assumptions:
- an increase in yield (1.6 tons per ha instead of the current figure of 0.9 tons per ha) throughout the area now under paddy (40,000 ha);
- the development of an additional 10,000 ha of bottom land for recultivation in 10 years.

4/ In 1967, the Upper Volta Statistical Service prepared different forecasts for the urban population and the migrant population, while retaining the 1963 INSEE assumptions with respect to the development of the total population and the rural population.

Source: INSEE: "Population Forecasts for French-speaking African Countries and Madagascar, 1963"; for Upper Volta in accordance with population survey, 1961. 1969 figures: mission estimates.

Table XIV - POPULATION DENSITY BY DISTRICT (CERCLE) AND ORD

	Population density per sq. km. 1970	1990 (est.)
Black Volta ORD		
District		
Nouna	12	18
Toma	27	40
Dedougou	14	21
Boromo	18	27
Hounde	8	13
Tougan	24	36
Koudougou ORD		
District		
Yako	59	87
Reo	48	87
Koudougou	77	119
Leo	7	12
Tenado	18	32
Ouagadougou ORD		
District		
Ziniare	46	71
Bousse	52	77
Ouagadougou	113	177
Sapone	39	60
Kombissiri	32	50
Zorgho	21	33
Manga	35	54
Zabre	35	58
Tiebele	77	134
Po	7	13
Yatenga ORD		
District		
Titao	20	29
Ouahigouya	48	69
Gourcy	64	90
Sequenega	82	112
Banfora ORD		
District		
Banfora	12	19

Table XIV (Cont'd) - POPULATION DENSITY BY DISTRICT (CERCLE) AND ORD

	Population density per sq. km. 1970	1990 (est.)
Kaya ORD		
District		
Kongoussi	37	52
Barsalogho	13	20
Boulsa	20	31
Pissila	27	42
Kaya	47	72
Diebougou-Gaoua ORD		
District		
Diebougou	25	39
Gaoua	20	31
Koupela ORD		
District		
Garango	52	84
Koupela	61	100
Tenkodogo	20	33
Bogande	12	16
Fada N'Gourma ORD		
District		
Fada N'Gourma	5	6
Diapaga	5	6
Bobo-Dioulasso (ORD) (to be established)		
District		
Bobo-Dioulasso	15	23
Orodara	13	20
Sahel ORD (to be established)		
District		
Oudalan	5	7
Djibo	7	11
Dori	10	13

ANNEX 2

CHARACTERISTICS OF AGRICULTURAL HOLDINGS

A. Size and Yields

1. The size and yields of agricultural holdings have been estimated in numerous reports but never in a general survey covering the whole country. Various fragmentary estimates, particularly those made in preparation for the 1967-70 Plan, show the following picture:

(a) The cultivated area is 0.3 to 0.5 hectare per inhabitant or 0.6 to 1.0 hectare per member of the working population. The area left fallow depends on the density of population; where the availability of land permits, the area left fallow should be at least four times the area under cultivation.

(b) The distribution of the cultivated area over the various crops differs according to region: as a general rule, food crops (sorghum, millet, maize and legumes) occupy approximately 85% of the total area, with the remaining 15% devoted to export crops (cotton and groundnuts).

(c) Yields of crops cultivated in accordance with traditional methods have been estimated as follows in official statistics:

ORD	Sorghum and millet kg/ha	Seed cotton kg/ha	Groundnuts in shell kg/ha
Ouagadougou	540	190	600
Fada-Ngourma	550	180	500
Banfora	800	-	700
Ouahigouya	450	100	450
Dedougou	600	300	500
Bobo-Dioulasso	660	150	600
Diebougou Gaoua	400	200	600
Kaya	460	100	500

These estimates differ quite considerably from those recorded on demonstration fields grouped by agricultural area (the boundaries of which do not coincide with those of the ORDs) and on extension plots set up by the ORDs.

2. The average cotton yield for the country as a whole is estimated at 300 kg/ha by the Compagnie Francaise des Textiles (CFDT) while the average yield for groundnuts is stated by the Institut de Recherches sur les Huiles et Oleagineux Tropicaux (IRHO) to be 700 kg/ha.

3. A typical farm of a family of ten people, including five workers, would have about the following cropping pattern:

Crops	Area in ha	Yield kg/ha	Production kg
Sorghum and millet	2.80	500	1,540
Maize	0.30	600	180
Legumes and various food crops	0.30	600	180
Cotton	0.40	300	120
Groundnuts	0.10	700	70
Rice	0.10	900	90
Total	4.00		

4. The number of work days required per season for growing various traditional crops is estimated to be 100 per hectare for sorghum, maize, legumes and miscellaneous food crops, 130 for cotton, 170 for groundnuts and 150 for rice.

B. Variability of Yields

5. The yields per hectare under cultivation vary enormously. The lack of equipment for proper land preparation, or organic manure to improve the water retention capacity of the soil, and supplies and equipment to combat pests, all make Voltaic agriculture highly dependent on rainfall, particularly before sowing and during the period of early growth. Recent trials conducted by the Institut de Recherches Agronomiques Tropicales (IRAT) have shown that sorghum yield was inversely proportional to the amount of rain in April/May. This rainfall promotes nitrification of the organic nitrogen in the soil; once the nitrogen has been released in this way, it is washed away and is thus no longer available for the crop, with the result that growth is slowed down. A prolonged drought after the fields have been prepared kills off the young seedlings; resowing is then required, but at a time that is too late for obtaining good yields.

6. The coefficient of variation (standard deviation expressed as percentage of the mean) of the yield has been calculated for sorghum in the different agricultural areas of Upper Volta, on the basis of the results obtained on the demonstration fields during the five years between 1961 and 1965. As the annual figures used were themselves the mean for a series of fields, the true variability at each point is certainly much greater, having regard to the fact that rainfall in a given year is not spread uniformly over the total region; the intra-regional variation should

therefore be added to that in production from one year to the next. Each sorghum demonstration field was divided into two plots, one employing traditional methods and the other receiving a dressing of mineral fertilizer; in this way it was possible to distinguish between the two modes of cultivation.

Variability of Sorghum Yields

Agricultural Area	Under Traditional methods		With mineral fertilizer	
	kg/ha	Coefficient of variation in %	kg/ha	Coefficient of variation in %
Ouagadougou	550	14	973	15
Fada Ngourma	602	17	939	15
Banfora	473	34	751	24
Ouahigouya	569	9	923	9
Koudougou	481	24	851	17
Dedougou	695	12	1,052	14
Bobo-Dioulasso	491	35	815	22
Kaya	644	25	1,002	26
Total	622	16	916	12

7. For Upper Volta as a whole, the yield in one year out of three may be higher or lower than 622 kgs ± 100 kgs; in other words, it may not reach 520 kg or it may exceed 720 kg. In certain regions (Banfora, Bobo-Dioulasso), it may with the same degree of probability vary from 310-320 kg to 660-730 kg. It should be noted -- subject to the reservation already made regarding the method of calculation -- that yields in Ouahigouya are relatively stable; this may be due to the skill of Yatenga farmers, who have been obliged to adapt their techniques to particularly unfavorable physical conditions.

8. The only series of data on yields for locality are available from fertilizer trials conducted by IRAT's station at Saria for the 9 years from 1961 to 1969. The first series is made up of control plots which did not receive any fertilizer; the second series was given 5 tons of manure, 8 kg of nitrogen and 24 kg of phosphoric acid per hectare each year.

Variability of Sorghum Yields at Saria

	kg/ha	Coefficient of variation in %
Without fertilizer	163	45
Organic manure and mineral fertilizer	977	45

The plots without fertilizer have produced very low yields since continuous cultivation has exhausted the soil. The treated plots give a much higher output. However, in both cases, the coefficient of variation is very high (45%), a figure which should be valid also under actual farming conditions in Upper Volta. On this basis, therefore, the mean national yield of 550 kg/ha will vary by ± 270 kg/ha one year in three, i.e. from 300 kg/ha to 800 kg/ha.

9. A similar calculation has been made on the basis of data on mean annual yields supplied by IRHO for its Banfora (9 years from 1959 to 1967) and Bobo-Dioulasso (5 years from 1964 to 1968) sectors, both for farms employing traditional methods of cultivation and those applying methods recommended by IRHO.

Variability of Groundnut Yields

	Banfora		Bobo-Dioulasso	
	kg/ha	Coefficient of variation in %	kg/ha	Coefficient of variation in %
Traditional methods	512	19	418	13
Improved methods recommended by expansion services	1,413	14	1,019	16

10. A series of yields from a plot of cotton at the Saria station, over a five-year period from 1961 to 1967, gives a coefficient of variation of 20% for a mean yield of 1,564 kg/ha, a high level of output due to the fertility of the soil.

11. In conclusion, therefore, the variability of yields in a given locality can be estimated at:

45% for sorghum and millet
16% for groundnuts
20% for cotton

C. Financing of Holdings

12. All the development programs undertaken in Upper Volta call for the use of mineral fertilizers, insecticides and equipment, all of which require more or less heavy cash outlays.

13. To facilitate the spread of these new techniques, loans of the following kinds have been made to farmers:

(a) short-term credit for fertilizers and insecticides, repayable at the time of marketing;

(b) medium-term loans for sprayers, cultivators and carts, with repayment over a period of two to five years.

14. Experience has confirmed the results found in other countries. First of all, while credit facilitates adoption of new methods during the first several years, it rapidly becomes much less necessary when the farmers have appreciated the usefulness of products or equipment supplied on credit. Thus the farmers of Yatenga, whose cash income would appear to be among the lowest in the country, buy carts costing CFAF 22,500 often without asking for a loan or with a loan for just one year for half of the price; practically all (96%) of these loans are repaid on the due date. On the other hand, credit has always failed when the equipment bought with it was ill suited to actual farming needs. In the areas covered by the ORDs of Koudougou and Ouagadougou, 71 percent of the maturities on five-year loans for the purchase of animal-drawn cultivators were unpaid in 1967. Among the factors responsible for these defaults were the insufficient strength of the donkeys used for traction, their susceptibility to trypanosomiasis and the lack of attention to animal health, the doubtful utility of the cultivator under conditions where essentially only subsistence food crops were grain (prior to the development of cotton growing in Koudougou) and the extent of other technical changes required to derive maximum benefit from better preparation of the soil (selected seeds, fertilizer, crop rotations including cash crops for export). Consequently the Banque Nationale de Developpement decided to suspend all medium-term lending until the situation was rectified.

15. Any plan for agricultural credit should therefore include a precise survey of:

(a) the self-financing capacity of the farmers, who can often raise not inconsiderable sums of capital by selling off part of their livestock;

(b) the rate of return on the proposed investment, bearing in mind the vagaries of the climate. A farmer who obtains a loan undertakes in effect to repay a fixed sum on a given date; however, the additional yield which is to help him pay off his debt depends in large measure on the rainfall. The total maturities should therefore never exceed the value of the minimum crop increase he can hope to achieve one year in three;

(c) methods that would facilitate the collection of sums due at the time of marketing.

16. Studies made when the 1967-70 Plan was prepared and the ORD development programs were launched give some idea of the rate of return on various technical improvements in terms of both the average yield and for probable minimum yield one year in three. On this basis average yields and the coefficients of duration were:

550 kg/ha for sorghum	± 45%
550 kg/ha for groundnuts	± 16%
300 kg/ha for cotton	± 20%

17. The table annexed, based on data from programs actually being carried out, gives estimates of the cost and benefits for projects in course of execution:

(a) seed treatment - 1.5 packages of Thioral per hectare of sorghum and 8 packages per hectare of groundnuts;

(b) fertilizer applications - 36 kg of phosphate of ammonia and 14 kg of sulfate of ammonia per hectare of sorghum, 75 kg of simple superphosphate per hectare of groundnuts, 72 kg of phosphate of ammonia and 28 kg of sulfate of ammonia per hectare of cotton;

(c) spraying of cotton - 3 sprayings of 2.5 liters of Endrin-DDT emulsion each, including depreciation and maintenance of the equipment;

(d) the use of animal-drawn equipment (a poly-cultivator and a cart for three hectares) with depreciation (including interest) spread over three years.

In calculating benefits, farm prices of products have been estimated at:

CFAF 12/kg for sorghum
CFAF 16/kg for groundnuts in the shell
CFAF 30/kg for seed cotton

18. It is evident from the annexed table that, in the light of the investments required, the profitability of animal-drawn cultivation is negative for sorghum, poor for groundnuts and relatively slight for cotton. This calculation, however, does not take account of income received from work performed for other farmers, which is generally a source of considerable income for owners of carts. The increase in areas made possible by the use of animal-drawn cultivators should also be taken into account.

COST AND BENEFITS OF NEW INPUTS AND METHODS

	Average				Minimum one year in three			
	Yield kg/ha	Cost CFAF/ha 2/	Gross receipts CFAF/ha.	Net profit CFAF/ha	Yield kg/ha	Cost CFAF/ha	Gross receipts CFAF/ha	Net profit CFAF/ha
Sorghum								
Seed treatment	+ 80	+ 30	+ 960	+ 930	+ 40	+ 30	+ 480	+ 450
Density and date of sowing	+ 195	+ 0	+ 2,340	+ 2,340	+ 110	+ 0	+ 1,320	+ 1,320
Mineral fertilizer	+ 325	+ 1,875	+ 3,900	+ 2,025	+ 180	+ 1,875	+ 2,160	+ 285
Animal-drawn cultivation1/	+ 150	+ 3,500	+ 1,800	- 1,700	+ 80	+ 3,500	+ 960	- 2,540
Groundnuts								
Seed treatment	+ 280	+ 160	+ 1,280	+ 112	+ 65	+ 160	+ 1,040	+ 880
Density and date of sowing	+ 85	+ 0	+ 1,360	+ 1,360	+ 70	+ 1,130	+ 1,120	+ 1,120
Fertilizer	+ 195	+ 1,500	+ 3,120	+ 1,620	+ 165	+ 1,500	+ 2,640	+ 1,140
Animal-drawn cultivation1/	+ 290	+ 3,500	+ 4,640	+ 1,140	+ 245	+ 3,500	+ 3,920	+ 420
Cotton								
Density and date of sowing	+ 50	+ 0	+ 1,500	+ 1,500	+ 40	+ 0	+ 1,200	+ 1,200
Insecticides	+ 500	+ 3,600	+ 15,000	+11,400	+ 400	+ 3,600	+ 12,000	+ 8,400
Fertilizer	+ 450	+ 3,800	+ 13,500	+ 9,700	+ 360	+ 3,800	+ 10,800	+ 7,000
Animal-drawn cultivation1/	+ 200	+ 3,500	+ 6,000	+ 2,500	+ 160	+ 3,500	+ 4,800	+ 1,300

1/ The increase in yield through animal-drawn cultivation is due largely to better soil preparation.
2/ Based on prices currently paid by the farmers.

ACTIVITIES IN THE YATENGA, KOUDOUGOU AND OUAGADOUGOU ORD AREAS

Table I: YATENGA ORD

		1967	1968	1969 1/
Groundnuts	- Output (in shell) tons	3,080	4,000	7,000
	- Marketed (shelled) tons	850	1,100	3,000
Cotton	- Output (tons)	300	400	1,000
	- Marketed (tons)	115	250	250
Sesame	- Output (tons)	300	400	720
	- Marketed (tons)	150	350	240
Plows	- Total number	703	804	1,073
Cultivators	- Total number	323	403	444
Donkey carts	- Total number	46	224	300
Shellers	- (units)	25	87	120
Sprayers	- (units)	2	17	27
Fertilizer (tons)		41	82	115
Seed Protection Products (25 g. packets)		51,000	80,000	74,500
Pest Control Products for grain stored (tons)		27	29	
Groundnut Seed distributed (tons)		82	99	122
Cotton Seed distributed (tons)		30	50	71
Wells sunk with FED assistance (number)		21	51	
Cost of well-digging (CFAF '000)		5,617	17,165	
Short-term credit (CFAF '000)		800	6,600	
Rate of repayment (percent)		99	96	
Land prepared with animal-drawn implements (ha)		2,550	5,200	7,000
Area sown in rows (ha)		2,500	4,500	5,300
Area fertilized (ha)		645	1,340	2,060
Technical Assistance Officers (number)		6	4	3
Local Senior Extension Officers (number)		6	8	8
Local Extension Workers (number)		56	64	73
Financing made available by FED (CFAF '000)	Total			
Technical Assistance Staff	87,551	33,692	35,177	18,682
Upper Volta Staff	34,110	11,550	11,850	10,710
Purchase of vehicles and equipment	3,810	2,760	280	770
Operations	16,500	7,000	5,500	4,000
Total	141,971	55,002	52,807	34,162

1/ 1969 production figures are estimates.

Table II: KOUDOUGOU ORD

	1965	1966	1967	1968	1969[1]	1970[1]
Groundnuts						
- Output (in shell) tons	-	-	2,840	3,445	4,135	5,260
- Marketed (shelled) tons	-	-	170	200	300	400
Cotton - Output (tons)	1,700	3,113	3,050	5,800	6,300	8,515
- Marketed (tons)	1,700	3,113	3,040	5,725	6,000	8,500
Plows (number)	-	-	-	-	-	-
Cultivators (number)	2,440	2,570	2,322	2,379	2,200	-
Donkey carts (number)	20	173	278	338	350	
Shellers	-	-	-	-	-	
Sprayers	73	183	339	589[1]	900	
Fertilizer (tons)	21	35	58	108	230	350
Seed Protection Products (25 g. packets) (number)	-	8,000	42,000	61,300	111,500	
Pest Control Products for grain stored (tons)	-	0.305	3	6	9.8	
Groundnut Seed distributed (tons)	-	21	12	9	-	
Cotton Seed distributed (tons)	-	-	800	900	600	
Wells sunk with FAC assistance	-	-	-	-	-	
Short-term credit (CFAF '000)	-	3,386	7,009	18,900	-	
Medium-term credit (CFAF '000)	4,073	7,718	9,893	10,794	12,948	
Rate of Repayment						
Short-term (percent)	96	-	98	-	-	
Medium-term (percent)	96	72	55	47	60	
Land prepared with animal drawn implements (ha)	3,050	1,715	2,041	-	-	
Area sown in rows (ha)	2,000	2,884	12,430	14,000	13,100	
Area fertilized (ha)	160	447	834	1,090	2,350	

1/ Target.

Table III: OUAGADOUGOU ORD

	1965	1966	1967	1968	1969 1/	1970 1/
Groundnuts						
- Output (in shell) tons	-	-	-	-	-	
- Marketed (shelled) tons	-	1,200	15	68	150	
Cotton - Output (tons)	-	-	1,105	1,800	2,400	
- Marketed (tons)	400	646	869	1,607	2,200	2,500 to 3,000
Sesame - Output (tons)	-	-	-	-	-	-
- Marketed (tons)	-	-	-	5	15	
Plows - Total number	-	225	10	-	-	
Cultivators - Total number	-	5,129	4,450	-	-	
Donkey carts - Total number	190	196	260	-	-	
Shellers (units)	-	-	4	-	-	
Sprayers (units)	-	7	31	-	-	
Fertilizer (tons)	45	68	54	90	99	
Seed Protection Products (25 g. packets) (number)	1,732	10,702	52,041	91,000	68,800	
Pest Control Products for grain stored (tons)	-	1,190	3,950	6	3	10
Groundnut seed distributed (tons)	-	106	90	85	4	(current)
Cotton seed distributed (tons)	-	163	250	350	490	(current)
Wells sunk with FAC assistance (number)	-	-	-	159 (for both ORDs)	-	
Short-term credit (CFAF '000)	-	4,344	3,437	2,425	2,000	for 69-70
Medium-term credit (CFAF '000)	10,951	17,351	11,234	9,043	8,085	
Rate of repayment						
- Short-term (percent)	-	-	92	94		
- Medium-term (percent)	96.3	56.4	23.7	26.1	38.5	
Land prepared with animal-drawn equipment (ha)	8,400	9,160	6,940	-	-	
Area sown in rows (ha)	6,300	10,058	18,000	20,780	23,609	
Area fertilized (ha)	358	813	730	890	1,195	

1/ Targets.

ANNEX 4 - PRICE STRUCTURE OF EXPORT CROPS

(In CFAF per ton)

I. Cotton - Crop Year 1969/70

Average expected price to producer		
68 percent 1st grade (a)	32,000	
32 percent 2nd and 3rd grade (a)	28,000	30,720
Collection costs (incl. ORD commission of CFAF 100)		1,100
Transport cost to ginneries		5,500
Total cost of seed cotton at ginneries		37,320
Total cost of cotton fiber at ginneries (assumed ginning outturn, 36 percent)		103,666
Ginning cost		18,000
Transport from ginneries to Abidjan port		475
Banking charges (based on rediscount rate of 3.5%)		2,400
Export license		200
Sales costs (Europe)		1,300
Insurance		1,200
Over Overhead costs		3,100
TOTAL COST f.o.b. Abidjan		136,341

Storage costs beyond June 30, 1970 are not included and were to be defrayed by Price Stabilization Fund on the basis of bills presented. They were expected to be CFAF 490 per ton fiber per fortnight.

II. Sheanuts - Crop Year 1969/70

	Scandinavia	Japan
Price paid to producer	7,000	7,000
Bonus to be distributed	29,234	26,723
Price to producer, Ouagadougou	36,234	33,723
Buyer's commission	500	500
Handling at point of purchase	500	500
Cost on Scale unbagged, Ouagadougou	37,234	34,723
Shrinkage (1 percent stored cost, Ouagadougou)	429	403
Four months' interest at 6.6 percent p.a. (2.166%)	930	874
Depreciation on cartage sacks	432	432
Packaging, 13.33 x 153	2,066	2,066
Warehouse rental, Ouagadougou	150	150
Exporter's commission	500	500
Overhead costs in Africa	1,200	1,200
Cost in warehouse, Ouagadougou (coef. 96.634)	42,941	40,348
Sealing and conditioning	130	130
Loading and trucking	409	409
Forwarding agents' charges	371	371
Shippers' charges	476	476
Rail transport to Abidjan	2,651	2,651
Statistical tax (1 percent of conventional export price)	27	27
Cost at rail station Abidjan	47,005	44,412
Transport, handling and loading charges, and fees, Abidjan	861	861
Warehouse rental, Abidjan	250	250
Wastage (1% cost f.o.b. Abidjan)	492	466
Port dues	66	66
Lighterage	478	478
Cost f.o.b. Abidjan (cof. 99)	49,152	46,533
Cost f.o.b. in old French francs	96,304	93,067

- over -

	Scandinavia	Japan
Interest charges (0.75% on c.i.f. value; 1.5% for shipments to Japan)	870	1,740
Wastage (1% of c.i.f. value)	1,160	1,160
Documents (0.5% of c.i.f.value)	580	580
Overheads (1% of c.i.f. price)	1,160	1,160
Removal from warehouse, loading, supervision	400	400
Freight to N. Europe or Japan	11,473	14,680
Brokerage (1% in Scandinavia, 2% in Japan)	1,160	2,320
Insurance (0.77%)	893	893
Cost c.i.f. Scandinavia - coef. 94.98 1000 kg)	116,000	117,856
Japan - coef. 93.23 1016 kg)	=======	=======
In pounds sterling	88.4.6	88.4.6

III. Groundnuts - Crop Year 1969/70	Scandinavia	Japan
Price to producer		25,750
Handling at point of purchase	250	
Buyer's commission	750	
Cost, unbagged, on scale, Ouagadougou		26,750
Wastage/dry-out (1% stored cost, Ouagadougou)	323	
Moving to store, allowance for tare, grading	250	
Four months' interest at 6.6% on storage, Ouagadougou	701	
Cartage	423	
Packaging 13.33 x 153	2,039	
Warehouse rental, Ouagadougou	150	
Exporter's commission	500	
Overhead costs in Africa	1,200	
Cost in Warehouse, Ouagadougou - Coef. 96.834		32,336
Sealing and grading	130	
Loading and trucking	409	
Forwarding agent's charges	371	
Shipper's charges	476	
Rail transport to Abidjan	3,640	
Statistical tax (4%)	27	
Cost on rail, Abidjan		37,369
Wastage (1% of f.o.b. cost)	397	
Transport, handling & loading charges, and fees, Abidjan	911	
Warehouse rental, Abidjan	400	
Port dues on 1,012 kg	66	
Lighterage on 1,013 kg	478	
Cost f.o.b. Abidjan - coef. 99		39,641
Cost f.o.b. in old French francs per metric ton		79,282
Interest charges 9% p.a. for 1 month (i.e. 0.75%)	729	
Wastage (1% of c.i.f. value)	972	
Valuation	150	
Freight to French port (8,500 x 1,013 + 10%)	10,637	
Documents (0.5% of c.i.f.value)	486	
Removal from warehouse, loading, supervision	671	
Overhead charges in Europe (1% of c.i.f. value)	972	
Impurity allowance (1.5% of c.i.f. value)	1,458	
Brokerage (0.5% of c.i.f. value)	486	
Insurance (1.19% of c.i.f. value)	1,157	
Cost, c.i.f. French port - coef. 93.56 a/	=====	97,200 ======

a/ Taking account of the Stabilization Fund subsidy of CFAF 9,000 per ton, the sale price c.i.f. French port is about CFAF 68,000 per ton.

IV. Sésame - Crop Year 1969/70	Scandinavia	Japan
Price to producer		26,750
Handling at point of purchase	250	
Buyer's commission	750	
Cost, unbagged, on scale, Ouagadougou		27,750
Wastage/dry-out (1% stored cost, Ouagadougou)	334	
Movint to store, allowance for fare, grading	250	
Four months' interest at 6.6% on storage, Ouagadougou	723	
Cartage	423	
Packaging 13.33 x 153	2,039	
Warehouse rental, Ouagadougou	150	
Exporter's commission	500	
Overhead costs in Africa	1,200	
Cost in warehouse, Ouagadougou - coef. 96.834		33,369
Sealing and grading	130	
Loading and trucking	391	
Forward agent's charge	371	
Shipper's charge	476	
Rail transport to Abidjan	3,640	
Statistical tax (1 percent)	27	
Cost on rail, Abidjan		38,422
Wastage (1% of f.o.b. cost)	406	
Transport, handling and loading charges, and fees, Abidjan	661	
Warehouse rental, Abidjan	400	
Port dues on 1,013 kg	66	
Lighterage on 1,013 kg	478	
Cost f.o.b. Abidjan - coef. 99		40,633
Cost f.o.b. in old French francs per metric ton		81,266
Interest charges 9% p.a. for two months (i.e. 1.5%)	1,575	
Wastage (2% of c.i.f. value)	2,100	
Ocean freight 25 x 555.42 x 1,013	14,065	
Valuation	150	
Documents(0.5 of c.i.f. value)	525	
Removal from warehouse, loading, supervision	400	
Overhead charges in Europe (1% of c.i.f. value)	1,050	
Impurity allowance (1.5% of c.i.f. value)	1,575	
Brokerage (1.0% of c.i.f. value)	1,050	
Insurance (1.19 of c.i.f. value)	1,250	
	=====	
C.i.f. Italian port - coef. 91.31		105,006
rounded to		105,000
		=======

ANNEX 5

STUDY OF A PROJECT FOR SETTLING THE WHITE VOLTA VALLEY

1. Given the complexity of this project, the necessary study and plan of action must be pursued gradually, so that the results obtained can be used as a continuing basis for improving the methods used. The first step is to make a study, outlining a project for the development of the entire valley by zones, setting priorities, and choosing the best place for the first pilot project, the methods and means of which will be precisely laid down. When this first operation has been completed, the program can be extended to other parts of the valley.

I. Study of the Development Possibilities and the General Development Plan

2. The possibilities for developing areas which can be cleared of onchocerciasis (river blindness) and trypanosomiasis (sleeping sickness) depend on:

(a) natural (ecological) conditions;
(b) the present population;
(c) farming methods;
(d) estimated agricultural costs and profits; and
(e) the extent of overpopulation of neighboring areas which might provide settlers.

3. The study of ecological conditions will fix the absolute limits of the project on the technical level.

4. The only existing maps are on a scale of 1/200,000 and provide a general idea of possibilities for development but not for water management; maps on a scale of 1/10,000 or even 1/5,000 are needed for all areas where irrigation is to be developed or roads are to be built.

5. The network of meteorological stations in Upper Volta is particularly dense. All necessary information on rainfall, evaporation, and temperature has already been recorded. All that is needed is to use existing data to determine the rainfall variation in the critical seasons: April-May before the land is prepared, May-June in the sowing season, and September when crops are ripe. This will reveal the probability of crop failure and of poor yields, which must be taken into account in any economic analysis.

6. A soil map at 1/200,000 was prepared by ORSTOM in 1964, showing the distribution of soil types by origin. It indicates that the most promising areas seem to lie in the south, but it cannot be used directly for a development project because it does not show the use to which the various soils should be put. Work must be resumed on this map, showing, on the same

scale, the principal factors limiting the production of possible crops (cereals, groundnuts, cotton and onions) including (a) the depth of the hard pan, (b) the susceptibility of soils to erosion as a function of relief and soil type, and (c) the depth of the water table in the rainy season.

7. The necessary information on general fertility and possible crops can be taken from the present map, interpreted in the light of results obtained at IRAT stations. This map will provide a basis for deciding how different parts of the valley should be developed, including (a) the crops that can be grown, (b) the methods of soil preparation that should be used, and (c) the yields that can be expected with certain crop rotations and the use of fertilizers.

8. In the areas to be settled, the soil characteristics defined above should be mapped on a scale of 1/50,000 so that the number of farms to be established can be determined. The areas to be provided with irrigation and drainage should be mapped at 1/20,000 to show up hydrodynamic features (permeability, absorptive capacity), whenever these may have a marked effect on the nature and cost of the work to be undertaken. These detailed studies must show not only the features recorded when the 1/200,000 map was drawn but also the irrigation and drainage systems for the various crops.

9. Surface hydrology has been studied superficially in the drainage basins of earth dams on the Volta tributaries. Although the Department of Hydrology and Rural Equipment could not furnish precise information, water-level gauges apparently exist and may have yielded enough data on surface-water runoff for the planning of simple hydroagricultural installations. Underground water resources have not yet been studied; the BRGM is to begin this work in the northern part of the valley at the Ouagadougou latitude in 1970. It must be extended to cover the entire valley, in order to locate the underground water in the various formations appearing on the geological map of the region. An inventory of water resources should be made for all existing and abandoned watering points; this will make it possible to measure extent and amount of underground water available in different parts of the valley. This inventory should be supplemented by a hydrogeological study based on exploratory borings which will show the hydrological features of each underground water source, making it possible to decide on the methods of tapping them, their location, and their discharge.

10. A quick survey must be made of the present land by population, to determine what land is available or can be released and under what conditions it can be put at the disposal of settlers. Details of present use are not known except for a few studies and reports on villages.

11. The vertical aerial photographs at 1/50,000 taken some ten years ago reveal the general distribution of population and crops. They are adequate for the valley as a whole, but in the south, population movements have brought about important changes which will require new aerial coverage; this

survey should be made at 1/20,000 to serve as a base for a more detailed set of maps of this area, where the best soil seems to occur. An interpretation of these photographs, accompanied by a ground survey, should show how the land is used (for crops, pasture, firewood) and who holds the usage rights.

12. An exhaustive census of heads of families living in the valley should be made, bringing up to date the lists of people subject to taxation kept by the administration. On this basis, a sample survey of farms should be conducted to record:

(a) the total and the active population, the birth, death and fertility rates, and the extent of migration;

(b) the area under cultivation, divided by crops according to the kind of land;

(c) the duration of fallow;

(d) legal rights to the different types of land; and

(e) the amount of equipment in use and the number of livestock.

13. A demographic survey in the uplands adjoining the valley should show the number of families it would be desirable to move in the light of the production of the soil as determined in the detailed studies already made of the general Ouagadougou area. The farming methods that are traditional in the areas of origin of the settlers cannot be transferred without change to the valley, since physical conditions there are very different. The intensive methods used by a limited number of farmers in the valley have been described by sociologists. They seem to be effective enough to warrant adoption by farmers who would be installed in the first stage near areas already under cultivation. In areas where ecological conditions are different and where the population density or planned development does not justify such intensive cultivation, it will be necessary to experiment to learn how to improve the crops now grown and how to work land which has never been cultivated or is to be put under new crops. Such experiments should be based on a study of the farms themselves and of the technical difficulties encountered by the farmers. New-crop research should be guided by experience with similar problems in comparable projects. The available data on soils show that the richest soils are very clayey, subject to deep fissures in the dry season and to rapid flooding. It therefore appears necessary, above all, to determine appropriate methods of soil preparation and of seasonal cropping.

14. Farmers will be attracted by the project only if they appreciate its advantages. It will therefore be necessary to devise farming patterns (area per crop, methods, equipment) that give the best results compared with those obtained on the plateau and that are at the same time compatible

with the means, especially the labor, available to the farmers. The various studies made when the ORD development programs were being drawn up should provide useful indications of the types of farms in the uplands. No similar analysis has been made for the valleys. A very detailed study must therefore be made of some farms representative of the broad types now in existence as shown by the sample agricultural survey. The points on which detailed information is needed are:

(a) the division of labor by seasons and by plant and animal production; and

(b) the cost of, and income from, the principal crops.

Similar data on new methods and new crops should be gathered with the help of results obtained on research stations. A very simplified system of linear programming can then be used to determine model farming patterns.

15. The general plan will define the types of economic activities for each zone (farming, grazing, or lumbering) and the measures necessary for their development. The choice among the various activities that are possible in one zone should be based on their foreseeable economic results and the guidelines set in the national development plan or by the national authorities. Linear programming can help to take into account all the recognized constraints and to illuminate the various options. The necessary development work will have to be decided in the light of productive requirements, ecological conditions, and the infrastructure that already exists. The work will have to be scheduled according to technical relationships of these factors.

16. It will then be possible to evaluate the general economics of the technical project and make any adjustments of detail that may be indicated.

II. Organization of Settlement

17. The development of the valley by farmers who have little or no knowledge of the area will require organization to:

(a) furnish settlers with material or financial aid in suitable form;

(b) set up the social and administrative infrastructure essential for community life and complete whatever development work as has been recommended in previous studies;

(c) train and guide settlers in their new tasks; and

(d) provide the supplies, credit, and marketing facilities that are the necessary conditions or normal consequences of economic activity.

This organization will have to take into account not only technical aspects of the project, but also the motivations and the family organization of the settlers, aspects which must be studied where they now live before anything is done.

18. The first settlers will presumably have to be recruited from among descendants of the former inhabitants in the valley. Information is available on the areas to which they have moved. A psychosociological inquiry should be made there to determine:

(a) the factors which would influence the heads of families in decisions whether or not to settle in;

(b) the particular family characteristics that would favor the move: its size and the number of active members; its position in the village of origin; its relations with social groups in the valley; and the level of technical ability it possesses.

This information should show what incentives will attract settlers to the available land, how many can be expected to move in the first years, and what methods and means should be used to train and organize them.

III. The Preparation of a Specific Project

19. Within the framework of the general outline below, the goal is to frame a specific project eligible for foreign financing. This project would constitute the first phase of a more general White Volta development scheme. The preparation of a specific project involves the following operations:

A. A Program to Eradicate Onchocerciasis in the Area

20. This will be part of the projected intergovernmental compaign against onchocerciasis. The measures that must be taken for the White Volta as a unit must nevertheless be defined. The operations to be carried out in the zones selected for the specific project must then be outlined. The organization dealing with endemic diseases in Bobo-Dioulasso (OCCGE), aided by the WHO, should prepare this part of the project and determine its cost.

B. General Study to Determine Priority Zones and Activities in the White Volta

21. The general study must cover:

(a) a soil inventory for the preparation of a general agricultural-development map of the valley;

(b) an inventory of water resources and a master plan for their use in the valley;

(c) a survey of the present situation (land use, population, land rights, etc.) with the help of a sample survey; and

(d) principles and master plan for a settlement project; type of farming, type of organization, population involved, migration incentives and motivation.

This study must conclude with recommendations on the zones to be developed as a matter of priority and the type of work to be undertaken, indicating methods of exploitation, development works necessary and scale of possible settlement. The preliminary general study must be done in accordance with very precise terms of reference, so that no time is wasted in the collection of data not strictly necessary for the identification of a project. It should be made by a firm of consultants.

C. Identification of a Specific Project

22. An identification mission will have to outline the specific project, with the specific task of working out the terms of reference of the studies to be undertaken for the detailed preparation of the project.

D. Preparation of the Project

23. In preparing the project, the various points emphasized earlier in the general discussion of the overall development plan must be considered with reference to the particular areas included in the project. The preparation should be entrusted to a consultant firm and should comprise:

(a) the special studies required, notably topography, detailed soil studies, preliminary projects for the development of water resources, and miscellaneous studies (population, land tenure, type of farming, etc.);

(b) the preparation of the preliminary technical project and evaluation of its economic benefits, on the basis of the following two alternatives: (i) spontaneous settlement

after the eradication of the vector of onchocerciasis, and (ii) organized settlement with supplementary investment costs (road infrastructure, housing) and extension services to farmers; and

(c) finalization of the project with the help of an IBRD mission.

ANNEX 6

COMMENTS ON A PROGRAM OF ACTION AGAINST ONCHOCERCIASIS IN UPPER VOLTA AND NORTH GHANA 1/

1. The campaign against onchocerciasis in the Volta River valleys, both in Upper Volta and in Ghana, is not only of considerable humanitarian importance but also of very great economic interest. These broad valleys, which are now practically uninhabited, have considerable agricultural potential (water and soil). They are especially important in that they are near heavily populated areas where there are scant possibilities of coping with the consequences of the population increase which has been accelerating for more than ten years.

2. The health and the economic problem are very closely related, since medical and entomological research has shown that the strategy of effective action against the fly responsible for transmitting onchocerciasis consists largely of modifying the ecological milieu. What must be done, in fact, is to eliminate as far as possible the breeding sites of the fly by eliminating the little breaks in the slope of river beds, occurring at rocky ledges, where the current is rapid and the water highly aerated. Such a change in the ecology favorable to the proliferation of the vector can be accomplished as an integral part of projects for developing agricultural production in these valleys. A series of small dams, appropriately located, would put most of the breeding sites under water and make possible enough control of the water to permit the intensive cultivation of rich soils. Such soils are scarcely cultivable at present, because they are flooded too long during the rainy season and there is not the reserve water supply available to irrigate them in the dry season. The installation of a series of embankments would make it possible to drain the best land early enough to permit cultivation before the advent of the dry season. According to recent papers by the entomologist Mr. Balay, it would not be necessary to try to eliminate the small waterfalls and rapids over the entire length of the river, but only those beginning 7-8 km downstream from the source.

3. The building of these various-sized dams will require careful topographic surveys and a survey of potential water resources. It would seem possible to build dams which will keep the rocky ledges covered by enough water to prevent the formation of the small waterfalls and rapids sought out by the flies as breeding sites. Since these involve submersion of part of the valley, it is also important to choose the location of dams not simply on the basis of eliminating the breeding sites of the fly, but also on the basis of the distribution of the various soil types.

1/ This note was prepared for the mission by Mr. Y. Lacoste, Professor at the Paris Geographical Institute. Mr. Lacoste has been a member of several missions to Upper Volta and is particularly familiar with the onchocerciasis problem and with that of the development of the White Volta.

4. From the agronomic standpoint, the value of the soils varies widely. The soil map prepared by ORSTOM for the Red Volta and White Volta valleys is based on a very complex physicochemical classification but gives practically no information on the agricultural value of all these soils. It will therefore be important to complement this study of soils with a survey of their potentialities for farming.

5. In much of the area of these valleys, natural processes and the effects of deforestation and reckless clearing of land (which are especially unfortunate in that much "classified" forest is involved) have given rise to serious and rapidly accelerating soil erosion. Measures must be taken to check this erosion, both to protect the last reserves of soil remaining in the region and to prevent the appearance of new fly breeding sites in the gullies during the rainy season.

6. The cultivation of these valleys must not lead to the disappearance of the sparse forests which remain, since some ecological balance must be maintained. But the land should be gradually divided into wooded and cultivated areas. The forest must be concentrated little by little in the areas most in danger of erosion and on the soils least useful for agriculture. Since there is a considerable number of livestock in these valleys, which form the axes of large scale livestock movements, the available land must be so allocated as to take account of the need for maintaining or creating a certain ratio between wooded area, livestock requirements, and those arising from the intensive cultivation of the most fertile soil.

7. Since these Volta valleys cover fairly large areas, it seems reasonable, at least at first, to make an overall analysis of the natural and human limitations and resources of a fairly small area. The White Volta valley, as far as the Navrongo area in North Ghana, appears to be the most promising. While the Red Volta River valley offers little in the way of water resources and soil and the Black Volta River valley suffers from the serious drawback of being very narrow and deep in many parts, the wide White Volta valley has large areas of usable soil and has a considerable water flow in summer. Furthermore, while the Red and the Black Volta lie in sparsely populated regions, the White Volta (in both Upper Volta and North Ghana) is bordered by areas where agricultural overpopulation, already a source of grave concern, will become worse in the next decades. It thus appears logical to concentrate research on the White Volta valley during the first phase.

8. The development of these valleys, which are now almost uninhabited, poses the problem of adequate settlement. A very careful analysis must therefore be made of the agricultural structure and the historical and sociological data in and around these valleys. Although the areas are largely uninhabited and forest reserves have been established (though they are little respected) so that wood cutting and cultivation are theoretically prohibited, it remains true that the area was fairly well settled until not too long ago.

Groups which took refuge or were driven back to the edges of these valleys still hold rights to land which appears ownerless. All precautions must be taken in settling the valleys, not only on the health but also on the sociological level. The present uncontrolled influx of squatters which is causing the deterioration of resources and very intensive exploitation of the land which will be hard to reverse later, must be stopped. The planned, gradual settlement of the land by coherent and effective groups must be undertaken as and when onchocerciasis is eliminated and a framework of extensive service is established.

9. Population movements are known to be very delicate operations. It therefore seems desirable to resettle the White Volta valley very gradually, step by step, starting with people now living near the uninhabited areas. In this connection, the White Volta valley offers a considerable asset in the form of the survival of a population nucleus which is of some size and particularly advanced. This is the group of villages of Niaogho and Beguedo (Garango district) with about 7,000 inhabitants in the two cantons of Garango district; these 2,500 live in Niaogho proper. The survival of these villages near the White Volta River in a zone subject to onchocerciasis poses many problems. A complex combination of ecological and historical factors seems to explain this population remnant, but the chief advantage of these villages is that their people are remarkably advanced farmers. Those of Niaogho in particular farm the alluvial soil of the valley intensively, growing several crops a year; employing transplanting and irrigation, and using heavy doses of manure, etc. Their experience offers proof of the natural potentialities of these valleys, even within the relatively restricted framework of completely traditional techniques. Average family income at Niaogho is about three times the figure for the Mossi plateau.

10. Although 80% of them suffer from onchocerciasis, these villagers at least for the time being, do not seem to have the disease in its most severe forms, possibly because the number of infesting stings per person is still relatively low. The recent desertion of the villages around Niaogho, however, may bring a very marked increase in the number of infesting stings and hence a considerable aggravation of the form taken by the disease.

11. It is therefore important to begin work as soon as possible on measures which will keep this population nucleus from withering and disappearing altogether. It is, in fact, doubly desirable under a program for the development of the White Volta valley. First, the villagers are already well settled in the valley. This eliminates the difficulties and risks of settlement in the early days of the plan. Then, these people are already doing a relatively intensive kind of farming, of the type that must be introduced throughout the best soil areas of the valley. These villages can thus be considered the nucleus of the first phase of the plan, after which the valley can be developed and settled gradually when the burden of fly infestation has been lifted.

12. In view of the fly's wide range (up to 100 km), it may appear futile to concentrate research and action in the White Volta valley. It is certainly necessary to introduce measures to eliminate the largest foci just outside the valley in order to prevent reinfestation. But since the infesting stings are made by older flies, whose range is much smaller (cf. the papers by Dr. Leberre and Dr. Roland), the concentration of action in a relatively limited area seems to be an adequately realistic approach.